MORE THAN JUST RICE:

The Impact of the Green Revolution on Livestock Raising in a Javanese Village

By

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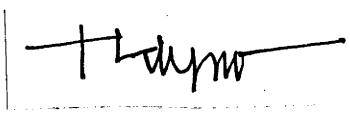
I declare that this thesis is my own composition,

and that all sources have been acknowledged.



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ABSTRACT

The Green Revolution (GR) has been spreading throughout rural Java over more than 27 years. However, there is no study on the socio-economic consequences of the Green Revolution which pays adequate attention to its impacts on livestock raising. This study reveals that long-term implementation of the GR has changed the patterns of livestock raising in the wet rice agricultural village situated in the enclaves of cattle population. Changes in livestock raising occurred as a consequence of increased peasant welfare due to the intensification of rice and secondary crop farming, which in turn led to the reformulation of farm and household economic strategies.

Larger farmers, and a small number of medium farmers, have more opportunities to invest their income than smaller farmers. Large farmers eschew cattle raising which offers lower income than other economic activities, such as investment in chillies, onions or other economic activities outside of agriculture. Conversely, cattle raising becomes the preferred strategy among small and tiny farmers in order to rise above the subsistence level and to enhance their household economic mobility. As a result, the tiny farmers, who make up the mass of villagers, have become the largest group of cattle raisers.

The increasing popularity of cattle raising has led to feed becoming increasingly scarce in the villages, even though the GR has increased the supplies of crop by-products, such as rice straw, rice bran and soybean "straw". All of which are suitable for cattle feed. The competition to obtain feedstuffs has become more fierce, and consequently, some feedstuffs have changed status from that of common property to individual property. These feedstuffs have also become labour payments in crop harvesting, replacing rice and monetary wage payments. This

feed commercialisation has reduced the access of tiny and landless farmers to sustainable feed supplies. They can achieve feed sufficiency only through hard work and exploit wild grass, which - as is presently practiced - degraded environmental productivity.

The privatization and commercialisation of feed are new phenomena in the GR - inspired agrarian transformation taking place in rural Java. These phenomena are exemplified in the villages which arose as centers of cattle raising, and support the arguments of the neoclassical perspective that the GR has led farmers to reformulate their strategies in order to counteract pressures on the land. The argument of writers of the neopopulists tradition that the GR has led to increasing economic inequality and commercialisation in rural areas is also supported.

With regard to the evidence that tiny farmers have become the largest group of cattle raisers and declining access to cattle feed, this study argues that cattle raising is only a short-term solution to population pressure in rice growing areas. Keeping cattle means that farmers maximise by-product utilisation. But this activity emerges in situations where population pressure exists in the village with few work opportunity beyond agriculture. As the short-term solution, cattle allow many tiny farmers and a small number of landless farmers to improve their economic base in the village, but in the future strengthening feed commercialisation may reduce their access to cattle raising due to their high dependency of feed production outside their farms.

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Chapter One

INTRODUCTION

1.1. The Objective of the Study

The objective of this study is to gain an insight into the pattern of livestock raising within the agro-ecological system of the lowland of rural Java, Indonesia. This study specifically attempts to analyse the impact of the Green Revolution on livestock raising in a wet rice agricultural village of the Bantul regency in the Province of Yogyakarta Special Region (Daerah Istimewa Yogyakarta).

In the studies on agro-ecological systems of Java, livestock raising seems to receive little attention among social scientists. Generally, their attention has been focussed on the social and economic dynamics of the wet agricultural system of lowland Java which is the most densely populated area (Palte, 1989:1). However, such studies have neglected livestock raising, the impression being that livestock is not an important economic activity among Javanese farmers (Koentjaraningrat, 1985:176).

In Java, although livestock raising is only a secondary economic activity, the arrangements of wet rice agriculture (*sawah*) cannot be separated from livestock raising system. Livestock scientists even argue that in a vast majority of Asian regions livestock and agriculture are combined within a mixed crop-livestock farming system (De Boer; 1982:18). Some argue that in most other Southeast Asian countries including Indonesia livestock is integrated into a farm management system and plays important roles in maintaining the ecological balance, especially in densely populated regions (Lebdosoekojo and

Reksohadiprojo, 1982:79). However this argument is questionable because the wet agriculture system at present has changed due to the introduction of the Green Revolution (GR) in 1967. The Indonesian 'New Order' government established the GR through the *Bimbingan Masal* Programme ("Mass Guidance") and *Intensifikasi Masal* (Inmas)[1] which is essentially a rice intensification programme. This package of programmes include (1) improvements of the water irrigation supply, (2) application of high yielding rice varieties (HYVs), (3) providing insecticides to control insect pests, (4) applying the use of fertilisers, and (5) enhancing rice farming by applying modern management (Fox, 1991:62). In the mid-1980s, after the success story in implementing Bimas and Inmas, the government introduced the *Intensifikasi Khusus* (Insus) programme which encouraged farmers to form groups in order to synchronise their rice planting year by year (Sawit and Manwan, 1991:84). Furthermore, in order to maintain sustainable rice production and to reduce the environmental impact of the conventional GR concept (Bimas, Inmas and Insus) the government introduced the *Supra Intensifikasi Khusus* (Supra Insus) programme in 1987 (Sawit and Manwan, 1991:84; Indrajaya, 1995:15).

The introduction of the GR in wet rice agriculture since 1967 has changed the agro-ecological system, and during this period these changes have affected the development of livestock raising. However, in studies on the economic consequences of the GR in rural Java, there has not been enough attention to livestock. Some studies on livestock raising emerged after the Indonesian

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[1]Bimas and Inmas were mass guidance extension programmes in which farmers were provided with technical advice by field extension workers. In Bimas, the government directly provided production credit, the subsidy of farm input and distribution of the new HYVs for increasing rice production. By Inmas, the government encouraged farmers to facilitate a package of rice intensification programmes based on self financing (Sawit and Manwan 1991:84).

government introduced hand tractors as an additional part of agricultural development (Sinaga, 1978; Lingard and Bagyo, 1983; Booth, 1988: 181-189; Kasryno and Saefudin, 1988; Manning, 1989; Naylor, 1992). In assessing the economic consequences of the GR, the impact of tractorization in rural Java provoked a debate about whether it has reduced the use of plough animals. However, by analysing macro data on the use of hand tractors, Kasryono and Saefudin (1988), and Manning (1989) would seem to end this debate. Despite the relatively rapid increase in the number of hand tractors since the mid-1970s, hand tractors still accounted for less than five per cent of all rice land cultivated in Java in the early 1980s (Manning, 1989:39). Although hand tractors may have reduced work opportunities in rural areas, farmers in several regions adopted this technology due to the lack of farm labour force and plough animals (Kasryono and Saefudin, 1988:45; Lingard and Bagyo, 1983:59).

Another seemingly endless debate in the literature about the GR is concerned with the degree and kind of economic consequences of the implementation of the GR in rural areas. One point of view is that GR technology gives more advantages to the larger farmers than to the smaller farmers because they have better access to land and input production (Booth, 1988, Collier; 1982; Edmundson, 1994, Hart, 1978; 1986; Hayami and Kikuchi, 1982; Manning, 1989; Young, 1988; White, 1989).

In this study I hope to show that the GR has increased peasant welfare, but has also increased agricultural commercialisation in rural Java. However, the most important changes have been in the attitudes of farmers toward secondary resources, both crop by-products and livestock.

The macro data shows that from the 1970s rice production steadily increased and in the mid-1980s Indonesia achieved rice sufficiency[2]. In Java, the average rice production per hectare was 2.6 tonnes in 1968, 3.2 tonnes in 1977, 4.73 tonnes in 1985, and 5.3 tonnes in 1992 (Fox, 1991:81; Biro Pusat Statistik Indonesia, 1993: 196). This increase in rice production has contributed to a reduction in the number of very poor people in rural Java because they participate in the rice farming program and because the supply of rice in the market has increased. The proportion of people who are classified as very poor has declined from 67.4 per cent in 1967 to 32.2 per cent in 1980 and 10.2 per cent in 1987 (Booth, 1988:193)[3]. Since the mid-1980s, farmers have generally not been faced with the insect problems which occurred in the period of the 1970s to the early 1980s. To control the insect problems, under government guidance, farmers began to reduce intensive rice monocropping by paying more attention to secondary crops (*palawija*) as a part of the *sawah* cropping system. This has had positive impacts on the *sawah* ecological balance (Fox, 1991:79). In the last decade, these crops have also supported the supply of livestock and poultry feedstuffs (Naylor, 1992:28-29).

Over the long-term, increasing rice production has affected the patterns of subsistence among small farmers. The improvement of rice production

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[2] At the national level, in the late 1970s, the production averaged 10 million tonnes of milled rice (*beras*), a year, by the mid-1980s, it had more than doubled to over 25 million, and by 1989 this production had reached 30 million tonnes (Fox, 1991:63).

[3] Booth (1993:57) defines very poor as having per capita monthly expenditure below the cash equivalent of 20 kg of rice per month. Poor is defined as having a per capita monthly expenditure between the cash equivalent of 20 and 26.67 of rice. Almost self-sufficient is defined as having a per capita monthly expenditure between the cash equivalent of 26.67 and 40 kg of rice; and self-sufficient is defined as having a per capita monthly expenditure above the cash equivalent of 40 kg of rice per month. There is no available data on very poor people in 1990s.

strengthens the capacity of farmers to achieve food-sufficiency which allows them to reformulate their subsistence strategies in rural areas (Belsky, 1993:131). Scholars taking a 'moral economy' approach like Scott (1976) argue that the basic pattern of subsistence strategy of the marginal farmers in Southeast Asia is to achieve 'safety first' or their household survival (See also Popkin, 1989:21). They see security as quintessentially important because they are poor and always close to the danger line, and a small drop in production can have destructive effects on the survival of the households (Scott, 1976:5, 13-55; Popkin 1979:21). There are various ways for meeting the 'safety first' principle, such as to increase supplementary income by self-exploitation, to diversify their cropping system or their income earnings, or to maintain patron-client relations as economic insurance (Scott, 1976:13-55).

The progress in rice and other crop production reveals that peasants have had success in alleviating their poverty. Furthermore, the increasing popularity of livestock raising indicates, as Popkin (1979:4) argues, that peasants continuously strive not merely to protect but to lift their subsistence levels through long- and short-term investment, both public and private. The objective of this study is to examine the effects of rice sufficiency on livestock raising as a mode of investment. It is also to assess how the increasing popularity of livestock raising during the implementation of the GR changed agricultural institutions thus affecting the distribution of village resources particularly livestock feedstuffs, and to examine how farmers readjusted to these institutional changes as a strategy for utilising crop by-products.

1.2. Background

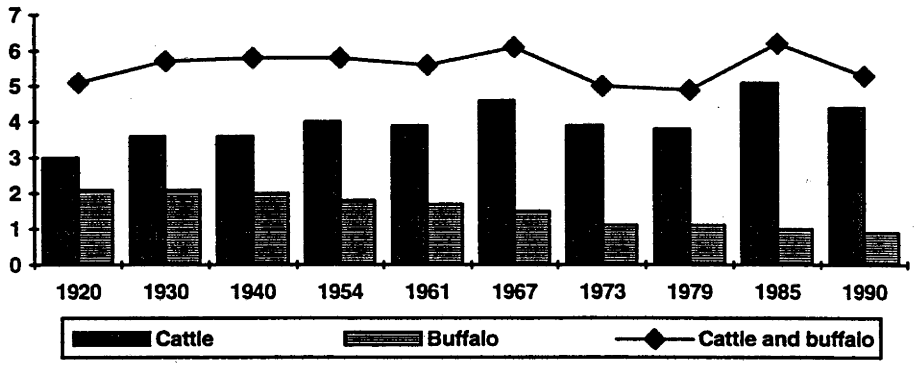
In rice growing areas, livestock husbandry is integrated within an intensive farming system. Arable lands are mainly utilised for intensive crop agriculture which means there is not sufficient herding land. Livestock, therefore, are fed in the housing compounds which restricts the size of the herd. Generally speaking, as an intensive agricultural system, *sawah* is a type of ecological adaptation that supports both a high number of people and animals (Manurung, 1990: 82; Nari, 1986:3). Geertz (1963) shows that Java can be a densely populated area because the *sawah* system provides a high yield production and the cultural ecology of the *sawah* system is adaptive to the increasing population. As the center of *sawah* agriculture, Java has also become an enclave of animal population in Indonesia. The available data show that between 1920 and 1990, the number of large ruminants in Indonesia has ranged from some seven to twelve millions, and between 50 and 70 per cent of these large ruminants (cattle and buffaloes) are to be found in Java which comprises only seven per cent of the total Indonesian area (Departement Van Landbouw Nejverheid en Handel-Netherland East Indies, 1928:272; Central Kantoor de Statistiek-Dutch East Indies, 1941:15; Bakker, 1945:2; Biro Pusat Statistik Indonesia; 1956:76; 1961:80; 1986:270; 1993:270; Woelke, 1983:189).

Compared with other agricultural sectors, livestock was an underdeveloped branch of Indonesia's economy, never receiving proper attention (Woelke, 1983:189). The government began to pay more attention to the livestock sector during the third Five Year Development Plan (1979-1984) by extending the livestock and poultry development budget (Soewardi and

Atmadilaga, 1982:126). Nevertheless, as in other Southest Asian regions, the Indonesian livestock development program did not change the husbandry management system (De Boer, 1982:16). This means that most cattle are managed by farm households rather than industrial businesses and the animals are fed by using local knowledge rather than veterinary science and its technological innovations.

Some livestock scientists argue that rice agricultural development has supported the growth of livestock population due to an increasing amount of agricultural by-products and residues for livestock feed (Satari, 1974; Soewandi and Atmadilaga, 1982; De Boer, 1982:14; Manurung, 1990; Nari, 1986). The macro data of livestock population, however, provide poor evidence that the GR has affected livestock raising. As shown in the Chart 1.1, the number of large ruminants in Java from 1920 to 1990 remained relatively static around 5.0 to 6.0 million head. Buffalo numbers declined slowly, while cattle increased steadily but fluctuated particularly during the GR era (1967-1990).

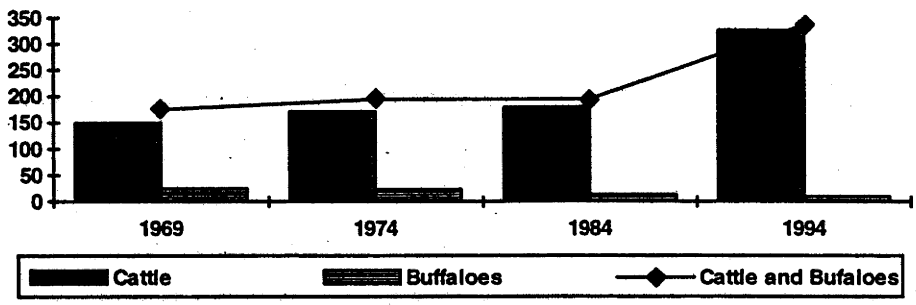
Chart 1.1. Large Ruminant Population in Java 1920-1990 (Million head)



Source: Departement Van Landbouw Nejverheid en Handel-Dutch East Indies (1928:272); Kantoor voor de Statistiek-Dutch East Indies (1941); Biro Pusat Statistik Indonesia (1956:76; 1961:80; 1986:270; 1993:270); and Woelke (1983:189).

The impact of the GR on livestock raising is best understood by observing the phenomena at the micro level. This impact should be greatest in areas where the cattle population is relatively large because the changes in the agro-ecological *sawah* system would directly affect the existence of animals which depend on *sawah* to get feed. In Java, cattle density is high in the provinces of East Java and Yogyakarta. For example, in 1976, the cattle density per 100 hectares of agricultural land in East Java was 106 head, and in Yogyakarta it was 100 head. Conversely, in Central Java it was 55 head, and in West Java it was merely 7 head (Kristanto, 1982:47). Based on the available statistical data, the impact of the GR on cattle population in Yogyakarta seems to be positive as argued by livestock scientists. The number of cattle raisers increased 45 per cent from 66,843 in 1983 to 97,008 in 1994 (Biro Pusat Statistik DIY, 1994a:39), and the number of cattle increased, particularly from 1984 to 1994 (See Chart 1.2).

Chart 1.2. Large Ruminant Population in Yogyakarta 1969-1994 (Thousand head)



Source: Figures of 1969, 1974 and 1984 are quoted from Dinas Peternakan DIY (1994: 3-5), and figures of 1994 are quoted from DIY (1994a:40).

By focusing on the enclave of livestock raising in Yogyakarta this study provides an insight into how changes in the agro-ecology *sawah* system affect the patterns of livestock feeding. These changes are not only in terms of increasing

crop production, its by-products, and wild grass, but also in terms of the feed distribution among farmers and their strategies in obtaining these feeds.

This micro study also provides an insight into how changes in the agricultural economy affect the patterns of livestock ownership, and husbandry systems. Many studies show that establishing the GR has caused the rise of economic commercialisation and inequality, others show an improving general farmer welfare such as a decline in the number of poor and destitute people and starvation in rural Java (Mubyarto, Sayogyo and Tjondronegoro. 1982: 222-224; Booth, 1988:193; 1993:65-74; Manning, 1989:69-70). One study documented that agricultural commercialisation also appears in the livestock feed distribution. In his study of the rice harvesting system, Sairin (1976) found that rice straw was used as a payment for harvesters who kept cattle.

1.3. Approach

This study is concerned with the management of livestock feed resources which is the most important strategy in small scale livestock raising in peasant societies. My research follows a new direction in human ecological studies by paying attention to the role of individuals in adjusting their environment rather than the role of the ecosystem in constructing the individual actions (Lees and Bates, 1984; Vayda, 1988:2; Loker, 1993; Putra, 1994:42). The particular focus of this study is to analyse the adaptive strategy of the cattle raisers rather than the ecological effects of their behaviour toward their environment.

The concept of ecosystems is applicable when analysing the small-scale livestock production systems of the groups who live in bounded areas with relatively few exchanges with other groups (Dyson-Hudson, 1983). The notion of

ecosystems specifically incorporates the idea of self-regulation. To understand a human ecosystem is to describe the roles that humans play in the maintenance or mutual regulation of relation between themselves, or other living species, and non-organic elements with which they interact (Lees and Bates, 1984:124). However, the Javanese village is not a closed community; therefore an ecosystems approach cannot easily be applied to analyse livestock raising in Java. This study is similar to human ecological research which is concerned with the impact of linkages between local and extralocal factors in human-environment interaction (Lees and Bates, 1984:138-139). It is intended to understand the adaptive strategy of farmers on environmental changes due to the implementation of the GR.

In studies of human ecosystems, the concept of carrying capacity becomes a tool of analysis to understand the interaction between population and environment (Dewer, 1984:601-602). This concept is important in understanding the management of livestock feeding due to the fact that livestock raisers utilise local resources rather than market products. In this study, the concept of carrying capacity refers to the supply of local feedstuffs to support the number of livestock in a community of farmers. By this concept, the number of cattle in the agro-ecological system is not assumed to be a function of ecological balance. In comparison, research on carrying capacity for human populations shows that over-usage of essential environmental resources may not result in the reduction of the local human population but rather in an intensification of efforts to acquire food from alternative resources (Lees and Bates, 1984:135).

The use of the carrying capacity concept is intended to understand how the people solve resource scarcity and the ecological effect of their adaptive

strategy. Geertz (1963) uses the concept of cultural ecosystem rather than biological ecosystem in analysing the agricultural involution process in Java (Putra, 1994:11). His model focuses on the capacity of *sawah* to produce food resources and the ways Javanese peasants solve the population pressure through organising the *sawah* system to absorb a greater labour force. In this study, it is shown that the management of the *sawah* system under the GR does enhance the production capacity of *sawah,* but increasing the cattle population creates new feed problems. The analysis of *sawah* productivity gives an insight into the process of agrarian change which affects the institutions of the feed distribution system, and the role of agents in manipulating the institutions and organising access to feedstuffs.

Hayami and Kikuchi (1982:5) appropriately define 'agrarian change' and the concept of 'institution' for this study. The term 'agrarian change' denotes "changes in the patterns of production and income distribution of rural communities involving major changes in institutions, such as property rights and contractual labour arrangement," and the term 'institution' is defined as "rules sanctioned by the members of the community" (Hayami and Kikuchi, 1982:5). To some extent, their economic approach to assess the institutional changes in the rice harvesting system is also applicable to analyse the feedstuff distribution in the village (Hayami and Kikuchi, 1982:49-52, 106). Their analysis reveals that the new rice technology has facilitated the ways Javanese farmers solve population pressures through readjusting their agricultural institutions. In this study, changes in the institutions which organise the feedstuff distribution are also examined as adjustments to the problems of population pressures in rural areas.

1.4. Problem Identification and General Research Outline

This research was conducted in the Bantul regency of Yogyakarta Province, one of the centres of livestock raising and wet rice agriculture in Java. The assessment of the long-term GR on livestock raising aimed to understand problems at the household level, by regarding the agro-ecological background of the village where the fieldwork was conducted.

There were three major research problems. Firstly, why did the cattle population increase during the implementation of the GR in the village? By exploring the place of livestock in the household economy, it is found that livestock has a role in economic household security, saving and economic mobility.

Secondly, what were the kinds of change in the agro-ecological *sawah* system due to the implementation of the GR which affected the patterns of livestock raising? These changes include (1) the increase in crop production, (2) the increase in the crop by-products and weed grass supplies, (3) the redefinition of the agricultural institutions. The analysis shows that the increase in rice and secondary crop production improved peasant welfare and hence supported the growing number of cattle. The increase in cattle population raised a number of questions about (1) the importance of livestock income in farm households, (2) the capacities of feedstuff produced by *sawah* to support the animal population overall, (3) the impact of the increasing cattle population on feed commercialisation, and (4) how the changes in agricultural institutions affect the feed distribution among the villagers.

Thirdly, what are the adaptive strategies amongst cattle raisers as a response to the changes in the agro-ecological *sawah* system? This problem is

divided into two major categories (1) to what extent do the adaptive strategies of livestock raisers achieve a sustainable feeding system, and (2) what is the implication of livestock feeding system on the process of the GR in the future?

Chapter 2 gives an insight into the agro-ecological background of South Bantul which represents the enclave of cattle raising in the field research. This chapter attempts to analyse the *sawah* cropping system, the sugar cane plantation system and the response to population pressure levels in South Bantul and North Bantul which in turn has influenced the pattern of livestock raising at present.

Chapter 3 describes the economic background of the village, and the implementation of the GR. This chapter discusses how the GR prompted *sawah* to become intensive in rice and secondary crop agriculture which improved peasant welfare, and brought changes in the economic strategies of farm households. In other words, the GR permitted farmers to readjust land scarcity and changed their economic strategies in utilising homegardens, cattle and other resources.

Chapter 4 analyses the impact of the long-term GR on the pattern of livestock raising. It describes (1) how the rise of peasant welfare affects cattle population, (2) the changes in livestock ownership in which tiny farmers become the majority of cattle raisers, and (3) the importance of cattle income particularly among tiny farmers.

Chapter 5 analyses *sawah* productivity of feedstuffs. Each feedstuff is assessed by regarding the supply and demand at the village and the individual levels. It also discusses the institutional changes in the feed distribution, and the various adaptive strategies of farmers in obtaining feed sufficiency. Chapter 6

summarises the research problems and findings, and formulates the basic pattern and sustainability of cattle raising as moulded by the GR.

1.5. Research Method

The field work was carried out in the village of Tirtomulyo, the sub-district of Kretek, Bantul. All field work data were collected from the middle of November 1994 until the middle of March 1995.

This research uses quantitative and qualitative approaches. The main point of the quantitative approach of this research is to analyse the general features of villagers' behaviours in managing their livestock raising based on the animal ownership and shareholding among the villagers, feed production and cattle breeding management, and access to *sawah* land and crop intensification. These quantitative data were collected using questionnaires surveying all households of livestock raiser, a total of 706 households. These quantitative data are referred to as primary data which are analysed by using statistical methods to calculate the means and modes of research variables and the correlation between the independent and dependent variables. These questionnaires were administered by myself and seven trained assistants, of whom two were outside students and five were high school graduates and tertiary students within the village.

A qualitative approach was used to enrich the understanding of the quantitative data. This approach aimed at an understanding of the villagers' vision of livestock raising which cannot be investigated by analysing quantitative data. Before and during the survey of livestock raisers, I collected the qualitative data, particularly ethno-ecological data concerning the villagers' knowledge about the development of agricultural intensification and livestock raising, and their

problem-solving strategies concerning livestock feeding. The ethno-ecological research used Spradley's ethnographic method. He suggests that ethnographic research is a study of culture which refers to "the acquired knowledge that people use to interpret experience and generate social behaviour" (Spradley, 1979:5). By taking this cultural perspective, this research collected from the villagers their cultural knowledge of livestock raising and the capacity of their environment. This research also interviewed three livestock raisers to get lifestory data in order to strengthen the interpretation and understanding of livestock development in the village. To support these data, this research also carried out observation. In particular, this research observed in detail some cattle raisers in collecting and feeding their animals.

Chapter Two

LIVESTOCK RAISING IN THE RICE GROWING AREAS OF THE BANTUL REGENCY

2.1. Introduction

The Bantul Regency can be divided into three agro-ecological zones: east, middle and west (Kantor Pusat Data Propinsi DIY, 1979:11-15; Sulistiyani, 1991:53)[1]. The general type of agriculture in the east zone is dry agriculture, and in the west zone is combined dry and wet rice agriculture[2].

The middle zone is known as the center of rice agriculture. It consists of ten sub-districts which are situated from the northern to the southern areas in the Bantul Regency. The total land area of the middle zone is 240.99 km^2, of which approximately 75 per cent is a flat river plain of regosol soil. Most of the arable land is used for wet rice fields which are irrigated from all the rivers in the Bantul regency. In 1993, the population density per km^2 was 1,814 persons (Biro Pusat Statistik Bantul, 1994).

The field research on livestock raising at the household level was conducted in the Tirtomulyo village of South Bantul, the southern area of the

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[1] The typology of an agro-ecological zone is based on the types of land and levels of plain which influence the development of agriculture in each zone. Based on this typology, some sub-districts on the boundary between two zones have two agro-ecological types because their areas represent two types of agricultures, both dry agriculture (*tegalan*) and wet rice agriculture (*sawah*). Nevertheless, by regarding the dominant type of agriculture, those sub-districts were categorised as a part of a single agro-ecological zone, whether the east, middle or west.

[2] The total land area of the eastern zone is 165.87 km^2, approximately 65 per cent of which is hilly terrain, the remaining 35 per cent of which is flat plains. In 1993, the population density was 1,017 persons per km^2. The total land area of the western zone is 99.89 km^2. Approximately 67 per cent of the land is flat plain and the other 33 per cent is hilly. The population density of this zone in 1993 was 1,346 persons km^2 (Biro Pusat Statistik Bantul, 1994:5).

middle zone. The *sawah* system in South Bantul is best understood by comparing it with North Bantul because both are situated in the middle agro-ecological zone of the Bantul regency. This chapter is intended to examine why both North Bantul and South Bantul have similar *sawah* managements, but cattle raising is concentrated in South Bantul.

The area of North Bantul covers 10,206 hectares and consists of four sub-districts: Bantul Town, Banguntapan, Jetis and Sewon. The area of South Bantul is 13,893 hectares consists of six sub-districts: Pandak, Srandakan, Bambanglipuro, Pundong, Kretek and Sanden. Although the total area of South Bantul is larger than that of North Bantul, the total *sawah* land is less. In South Bantul, the *sawah* land is 5,356 hectares, while in North Bantul 5,556 hectares.

South Bantul has been known as the center of large ruminants in the Bantul regency since the colonial era. It has two livestock markets, in Sanden and Pandak, which have existed since the 1930s. On the other hand, in North Bantul there is no livestock market, although this area has the Bantul town which became the center of trading in the Bantul Regency.

2.2. *Sawah* Pattern in North and South Bantul

Table 2.1 summarises the different *sawah* patterns between North and South Bantul prior to the GR. It shows that the patterns of *sawah* differs according to the irrigation facilities and sugarcane plantations. From the 1930s to the 1960s, *sawah* systems in North and South Bantul were similar in the sense that the main crop was rice, but patterns of crop intensification and land tenure were different. North Bantul focused on rice as a mono-culture, while South Bantul focused on rice and secondary crops called *palawija*. However, due to the

governmental pressures, most *sawah* fields in North Bantul until the 1960s were used for sugarcane plantations. There were no sugar plantations in South Bantul, except in seven villages which had good irrigation.

In North Bantul, most *sawah* fields had enough water for rice to be planted during the wet and 'spring' (*gadu)* seasons. Most *sawah* fields in this area were used as sugarcane plantations. Under the colonial law "Vorstenlandsch grond huurreglementen 1918", *sawah* fields in North Bantul were rented to sugarcane plantations. The duration of land renting was two and half years and was generally extended several times (Gordon, 1983:34).

Table 2.1. General *Sawah* Pattern in North and South Bantul Before the GR

North Bantul	South Bantul
1. Most *sawah* fields had good irrigation.	1. Most *sawah* fields did not have sufficient irrigation.
2. Rice monocropping (most *sawah* fields were planted in rice twice a year).	2. Rice and secondary crop cultivation.
3. Most *sawah* fields were used for sugarcane plantations.	3. A small number of *sawah* fields were used for sugarcane plantations.

Source: Interviews with villagers and governmental officials, 1994. Unfortunately, no quantitative data are available.

Sugarcane plantations in North Bantul during colonisation and up to the 1960s did not promote cattle raising. *Sawah* fields which were used for sugarcane were not perceived to produce sufficient feedstuffs. The tops of the sugarcane plant (*pucuk*) could be used for buffalo and cattle feed. However, according to farmers, *pucuk* was a lower quality fodder than rice straw and could not be stored

as long. Moreover, the production of dry *pucuk* per hectare was lower than that of rice straw (Nari, 1986:7). Data of rice and sugarcane production in the 1960s indicate that one hectare of *sawah* produced 6.4 tonnes of dry rice straw, or 1.5 tonnes of dry *pucuk*. The annual production of *pucuk* was lower than rice straw because each year a *sawah* field could be planted twice with rice, but only once with sugarcane. In fact, sugarcane needs 16 months for growing (Gordon, 1983:34). Furthermore, sometimes the farmers could not participate in sugarcane harvesting to get the *pucuk* because the industry used wage labourers.

Sugarcane plantations also led to an unstable supply of rice straw. Because of the timing demands of the sugarcane planting, all rice in North Bantul was planted in the same month, so they were harvested at the same time. This limited the opportunities to obtain rice straw beyond the village. During harvest time, the supply of rice straw was abundant in the fields, but the cattle raisers could not collect a sufficient amount for feed. Harvesting at the same time, farmers were too busy in their own fields to collect rice straw beyond their village. Prior to the 1970s, when a majority of farmers did not have bikes, they did not have enough time to collect rice straw in great amounts from the *sawah* of neighbouring villages. Also, they lost these opportunities because after finishing the harvest of their rice, the owners who did not keep cattle would burn their rice straw to fertilise the soil or to clean the fields before the second planting.

Sugarcane planting also did not require cattle or buffalo to plough the fields, so this reduced the work opportunities of farmers to hire out their animals. According to farmers, sugarcane crops were planted on the plots of land which were divided into several necks (*galuran/gundukan*), each neck separated by a

deep drainage ditch (*kalenan/lubangan*). Buffalo or cattle cannot be used to make the flat neck of a sugarcane field, or the deep drainage ditch. These must be made by using man power despite the fact that this takes longer.

The sugarcane plantations reduced peasant welfare and the intensity of *sawah* cropping. The effect of sugarcane plantations on the village economy was onerous (Gordon, 1983:35; Mahoney, 1978:91). Soemardjan (1962:275) estimates that farmers in Yogyakarta were forced to work approximately 150 days a year to fulfil their unpaid compulsory labour requirements. By working in sugarcane crops, farmers had little time to collect grass which must be done daily. Furthermore, sugarcane competed with wet rice agriculture, and thus reduced the *sawah* areas available for food production to fulfil subsistence needs (Donner, 1987:76). Depending on when the crop was planted, sugarcane could have replaced five or more crops of rice or other secondary crops (Fox, 1993:142).

In 1948, after Indonesia achieved Independence, the government accepted the farmers' pressure to rescind the unpaid compulsory labour requirement for the sugarcane plantations (Gordon, 1983:32-39). Nevertheless, the villages that previously were the sugarcane plantations still had to rent their land for sugarcane crops, and farmers were still forced by the village headmen to work in the sugarcane fields (Gordon, 1983:38).

Until the 1960s, the sugar industry cooperated with the government to cultivate sugarcane in North Bantul rather than in South Bantul. The Indonesian government then established *Tebu Rakyat Intensifikasi* (Intensified Smallholder Cane) in 1975, a new programme of sugarcane plantation to replace the old system which exploited the farmers (Mubyarto, 1981:50; 1983:80). Participation in this programme was not compulsory, and most farmers recognised that this

program did not give them any benefits (See also Mubyarto, 1981:57-58). Farmers in North Bantul as well as South Bantul were reluctant to join. Therefore, in the Bantul regency, most of the land for *Tebu Rakyat Intensifikasi* belongs to the village government (*pemerintah desa*), not the local villagers.

Table 2.2. General *Sawah* Pattern in North and South Bantul During the GR Era

North Bantul	South Bantul
1. Almost all *sawah* fields have very good irrigation and rice can be planted three times a year.	1. Almost all *sawah* fields have good irrigation, but rice can be planted twice a year only.
2. Almost all *sawah* fields are planted for rice twice and *palawija* once a year.	2. Most *sawah* fields are planted for rice twice and *palawija* once a year.
3. Rice intensification is relatively high.	3. Rice intensification is relatively low.
4. *Palawija* crop diversification is relatively low.	4. *Palawija* crop diversification is relatively high.

Source: Interviews with villagers and governmental officers, 1994. Unfortunately, no quantitative data available.

Unlike in North Bantul, during the colonial era most *sawah* in South Bantul were not used for sugarcane plantation due to the lack of irrigation. Only 7 out of 23 villages in South Bantul had enough water supply in the wet and *gadu* season for use as sugarcane plantations.

By improving irrigation, the villagers were increasingly able to intensify rice cropping to twice a year. Nevertheless, when the *sawah* lacked water during the *gadu* season, farmers planted *palawija*. The main *palawija* crops were maize, soyabean, peanut, sweet potato, and cassava. Comparing *sawah* with rice and sugarcane crops and *sawah* with rice and *palawija* crops, the latter produced

better feed supplies. This available feed supply was one reason why South Bantul had more large ruminants. Another reason was that the low rice productivity of the *sawah* led farmers to enhance their income earning by keeping animals.

In the late 1930s, the government built the Kamijoro dam on the Progo river in western Bantul to improve the water supply for *sawah* in South Bantul[3]. Thereafter eighteen villages of South Bantul enjoyed a good water supply. Unfortunately, during the struggle for Indonesian Independence (1945-1949), this dam was breached, cutting off water to some channels providing irrigation for South Bantul (See also Mantra, 1981: 50).

In the 1960s, there were eleven villages in South Bantul which had insufficient water supply during the *gadu* season. These villages developed intensive rice and *palawija* cultivation which had a positive impact on ruminant feed resources. Firstly, by planting *palawija* crops twice a year, farmers had the crop by-products which became green feed-stock that functioned as a grass substitute. Furthermore, because *palawija* did not need irrigation, they could be planted in any month. As a result, the period of planting and harvesting of *palawija* crops in South Bantul was as long as the dry season. This long harvesting season gave cattle raisers an opportunity to obtain available feed resources every month during the dry season. The by-products of *palawija*, vines (*rendeng*) and soyabean hulls (*titen*), can be stored for six months, so these can also be used for overcoming the wet season hiatus when rice was planted.

The differences between the *sawah* management in North and South Bantul decreased steadily after the establishment of GR in 1967, which

[3] According to the Tirtomulyo village headman, the government built the dam in order to increase the *sawah* productivity and to extend the sugarcane plantations. As a result, after the irrigation channels had been built, some villages in Bambanglipuro and Kretek were used for sugarcane plantations.

diminished the importance of sugarcane. Table 2.2 shows that the patterns of the *sawah* system in each area are not much different even though each still reflects previous *sawah* patterns.

Table 2.3. Harvested Crop Areas and Crop Intensification Index in North and South Bantul in 1993

No.	Kinds of Crop	Harvested Crop Areas in Hectare (ha.)		Crop Intensification Index	
		North Bantul	South Bantul	North Bantul (5,556 ha.)	South Bantul (5,356 ha.)
1.	Rice	8,875	7,781	1.60	1.45
2.	Soyabean	1,979	2,498	0.36	0.47
3.	Peanut	936	1,389	0.17	0.26
4.	Maize	232	450	0.04	0.08
5.	Cassava	20	63	-	0.01
6.	Chilli	16	488	-	0.08
7.	Onion	3	832	-	0.16

Note: 1. Analysis of data sourced from Biro Pusat Statistik Bantul (1993, 1994).
2. The crop intensification index is computed from the proportion of harvested crop area to the total *sawah* land. If a crop is cultivated twice a year, the intensification index is two because the harvested crops area will be double that of the total land.

After 1967, the government renovated all irrigation in the Bantul regency to facilitate more permanent irrigation which permitted almost all *sawah* fields in North Bantul to enjoy sufficient water supplies. This allowed farmers to plant rice three times a year toward the end of the 1970s. However, most *sawah* in South Bantul are only planted in rice twice a year. At present there are eleven villages still lacking water irrigation in the *gadu* season even though their *sawah* land can be planted with rice. In 1990, the eleven villages cooperated to repair the Kamijoro dam[4]. The Bantul regency government also financed this rehabilitation.

[4] The Tirtomulyo headman reported that the rehabilitation was not successful. Therefore, in 1994, the eleven villages made a new dam rehabilitation proposal to the Ministries of Agriculture and Public Works.

Nevertheless, this has not allowed them to irrigate all *sawah* fields in all villages at present since not all the damaged water channels which had been utilised by the inhabitants in South Bantul for agricultural fields and settlements have been repaired.

By adopting the GR, most farmers in North Bantul have been able to intensify rice and secondary crops. In the 1970s, farmers in the North cultivated rice three times a year, while most farmers in South Bantul cultivated this crop twice a year, in the wet and *gadu* seasons. The dry season is utilised to cultivate *palawija*. However, in the early 1980s farmers of North Bantul began to intensify *palawija* in the dry season. They had experienced that planting rice three times a year led to the decline in production because the brown planthopper (*wereng coklat*) was able to proliferate over a full year (See also Fox, 1991:68).

Since the mid-1980s, the *sawah* patterns in North and South Bantul have become more similar. Table 2.3 shows the relative patterns of crop harvested area and the crop intensification index in these areas. The absolute figures of each crop intensification are probably higher than the figures in this table because of some methodological weaknesses in collecting the data[5]. This table indicates that North Bantul has a greater production of rice, and the rice intensification index is higher than that in South Bantul. South Bantul still reflects the previous cropping pattern, in which the secondary crop intensification index is relatively high. Nowadays, several villages in South Bantul stress chilli and onion cultivation.

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[5] Officials collected the data from the key informants and officials at the village level, thus the data were not collected in a survey of individual farmers. They ignored the fact that many farmers in South Bantul plant soyabean, peanut and vegetable crops intensively. They also ignored the fact that in Kretek and Sanden farmers planted chillies and onions to replace some *palawija* crops.

The change in the *sawah* systems in North and South Bantul after the establishment of the GR has caused changes in the cattle population. Cattle numbers have increased in both areas but much more rapidly in South Bantul[6] (See Table 2.4). The different cattle densities between the two areas was a result of the villagers' different responses to population pressure. In 1993, the population density in North Bantul per km^2 was 2,293 persons, and in South Bantul 1,494 persons (Biro Pusat Statistik Bantul, 1994:38). The pressure on land in both areas is strong, but in North Bantul it is stronger. In North Bantul, the ratio of *sawah* per household was 0.09 hectare, while in South Bantul it was 0.11 hectare (See Biro Pusat Statistik DIY, 1994b:126; and Biro Pusat Statistik Bantul, 1994:38). The problem of population pressure is aggravated by the growing settlement on *sawah* land, a phenomenon which is stronger in North Bantul than in the South (Sulistiyani, 1991:201). Much *sawah* land has been used for settlement in North Bantul because this area is close to Yogyakarta city which has expanded its boundaries into the villages in North Bantul.

The population pressure in North Bantul forces people to work in other than the agricultural sector (Penny and Singarimbun, 1973; Mantra, 1981; Maurer; 1989; Sulistiyani, 1991). In 1994, in North Bantul, the proportion of all households working in the agricultural sector was only 38 per cent, while in

[6] There are three sources of governmental livestock data: (1) National Agricultural Censuses (2) Annual Statistical Reports, and (3) Livestock Husbandry Office. The first and the second are published by the Statistical Bureau Offices at the national, province and regency levels. The livestock data from the three resources, however, record different figures for cattle populations. They are unable to record the real figures because of methodological weaknesses. I use the data form the National Agricultural Censuses because they are more reliable than that of other sources. They complement my field research findings in the village, because these data were collected through surveying the cattle population at individual levels. The data sourced from the Annual Official Report and Animal Husbandry Offices might be collected from key informants particularly village officers and then the information was published as government reports. In many cases, the information by the village official reflects the number of livestock raisers rather than the number of livestock.

South Bantul it remained at 70 per cent (Biro Pusat Statistik DIY, 1994b:126). Many people in North Bantul have the opportunity to work in various enterprises which have linkages with the urban economic sector. In addition, they also have a wider opportunity to work in the informal sector in the city of Yogyakarta. Maurer (1991:102-103) found that in Timbulharjo village (North Bantul) the process of land fragmentation was followed by an increase in the number of inhabitants who work in the urban economic sector. In 1987, more than 4,500 persons, or 40 per cent of the village population, were commuting daily (*nglaju*) to Yogyakarta (Maurer, 1991:103).

Table 2.4. Cattle Population and Density in North and South Bantul in 1983 and 1993

No.	Areas	1983		1993	
		Number of cattle	Cattle Density per hectare of *sawah*	Number of Cattle	Cattle Density per hectare of *sawah*
1.	North Bantul	10,822	1.9	11,511	2.1
2.	South Bantul	13,773	2.6	21,318	4.0
	Difference	2,951	0.7	9,007	1.9

Source: Analysis of data sourced from Biro Pusat Statistik DIY (1985:12; 1994a:99)

People in South Bantul, on the other hand, have less opportunity to work in the urban economic sector. The greater distance of the villages of South Bantul to Yogyakarta (between 12 and 37 km^2) limits the possibilities for the villagers to work everyday through circular mobility (See also Mantra, 1981). As a result, most people in South Bantul depend on *sawah* agriculture to meet their livelihood, and to increase their income many of them practise cattle raising. Keeping cattle, seems to have become the best solution to the problem of population pressure in South Bantul at present.

2.3. Summary

In conclusion, this chapter has shown that previously South and North Bantul had different *sawah* management systems which affected the development of livestock raising in each area. The obligatory renting of North Bantul sawah to sugarcane production limited both the need for cattle as plough animals and the feedstuffs necessary for livelihood. The long-term implementation of GR has both increased rice and secondary crop intensification and reduced the difference between *sawah* management in the two areas, but has not changed the overall patterns. The GR has supported a greater increase in cattle numbers in South Bantul than in North Bantul. This is because cattle raising was previously an important adaptive strategy in the multi-cropping *sawah* system, and it now has become the preferred livelihood strategy because there are few other work opportunities outside the agricultural sector.

Chapter Three

TIRTOMULYO VILLAGE AND THE GREEN REVOLUTION

3.1. Geographical Site

Tirtomulyo is a village (*desa*) in the Kretek sub-district of South Bantul. The total area of Tirtomulyo is 419 hectares. As a community, this village is divided into 15 hamlets (*dusun*), each with its own wet rice fields (*sawah*), and settlement including homegarden fields (*pekarangan*).

Geographically, Tirtomulyo is located between the two roads connecting Yogyakarta municipality with the two tourist beaches of Parangtritis and Samas. The distance from Tirtomulyo to these beaches is about six km, while to the town of Bantul it is about 12 km, and to Yogyakarta about 22 km.

Like other areas of South Bantul, this village has a longer dry season than wet season and the annual rainfall is relatively low. The annual number of rainy days in 1989-1993 was 94 days. The wet season occurs from January to April with an average monthly rainfall of 416 mm. The dry season occurs from May to November, with rainfall per month of 40 mm, but from June to October there can be almost no rainfall (Biro Pusat Statistik Bantul, 1994:2).

In general, the water supply for irrigating *sawah* in Bantul is dependent on rainfall because all the rivers that provide irrigation water, particularly in South Bantul, are "intermittent" rivers (Kantor Pusat Data Propinsi DIY, 1979:29). The water level of these "intermittent rivers" increases rapidly during the wet season and declines in the dry season, with sufficient water for irrigation available only during the wet season.

3.2. Human Population

Tirtomulyo is one of the most populous villages of South Bantul. In 1993, the population of Tirtomulyo was 6,838 persons, and the population density was 1,632 persons per km^2, while the average population density of the Kretek sub-district was 1,101 persons, and for the Bantul Regency 1,438 persons. The dense population of Tirtomulyo has been due to natural population growth, although this has, in fact, been relatively low in the last ten years. As in the Kretek sub-district, the population growth in the last five years has been zero (Effendi, 1990: 43). This static population growth is occurring not only because of a low rate of natural growth but also because of a high rate of out migration. Every year, many young people migrate to the cities like Jakarta, Semarang, Surabaya, Bandung and Yogyakarta to find work. It is only if they have difficulty in getting jobs in the cities that they remain in their homeland.

Table 3.1. Distribution of Labour in Tirtomulyo according to Occupations, 1994

No.	Occupation	Per Cent
1.	Agriculture	72.0
2.	Trade	12.0
3.	Service	5.0
4.	Government	4.0
5.	Home industry	4.0
6.	Factory	3.0
	Total	100 (N=3,990)

Source: Village office Records, 1994.

There are efforts to earn income outside of agriculture by participating in small-scale trading, creating home industries and keeping livestock. As in rural

Java in general, the agricultural sector as the basis of the rural economy absorbs the greatest amount of the labour force[1] in the village. Most of the labour force worked in the agricultural sector (72 per cent) cultivating their land, or working as hire labourers (See Table 3.1). In 1993, the number of households was 1,475 units and on average each had 4.8 members. The primary occupation of most household heads was in the agricultural sector; with 70 per cent classified by village officials as farmers (See Table 3.2).

Table 3.2. Distribution of Household Heads (H.H) in Tirtomulyo according to Primary Occupations, 1994

No.	Primary Occupation	H.H	Per cent
1.	Farmers	1,046	70.0
2.	"Landless Farmers"	202	13.7
3.	Traders	64	4.3
4.	Civil Servants	67	4.5
5.	Artisans	42	2.9
6.	Manufacturing labourers	39	2.6
7.	Entrepreneurs	15	1.0
8.	Others	10	0.7
	Total	1,475	100.0

Note: 1. Source: Data of the village office and information from the village officials.
2. The primary occupation in this table is the occupation of the head of household, formally the husbands but including widows or women without husbands who head households.
3. Farmer refers to those who manage *sawah*. "Landless farmer" refers to those who work as wage labourers on others' land; they own no sawah but may own *pekarangan*.

3.3. Economy

In general, Tirtomulyo people live in a peasant economy in the sense that they depend on small-scale agricultural production to earn their living by

[1] Labour force is defined as those is above 10 years old who do not study at school.

cultivating subsistence and market crops. The sources of income are wet rice fields (*sawah*), homegardens, poultry and livestock, and non-farm employment.

Farmers plant rice and secondary crops (*palawija*) in their *sawah*. Among small and very small farmers (*petani gurem*), rice is mainly for subsistence consumption, while *palawija* is for cash income. To some extent, their farming system reflects subsistence strategies which are aimed at maintaining food sufficiency (Scott, 1976:36). However, among large and medium-scale farmers who achieve a surplus production, rice is used not only for subsistence consumption but also for cash income.

Table 3.3. Distribution of Farmers in Tirtomulyo, 1994

No.	Categories of Farmers residents in village	Land ownership (In Hectare)	Number of Farmers	Per- Cent
1.	Large Farmers	0.5001 - 2	35	2.8
2.	Medium Farmers	0.2501 - 0.5	127	10.2
3.	Small Farmers	0.1251 - 0.25	233	18.7
4.	Tiny Farmers	0.025 - 0.125	651	52.2
5.	Landless Farmers	-	202	16.1
	Total		1,248	100.0

Source: Data of the Kretek sub-district office and other resources, such as the Tirtomulyo village office and some hamlet leader information.

There are 260 hectares of *sawah* land in Tirtomulyo, 240 hectares of which are owned under individual title while the remainder are owned by the village government as village treasury land (*tanah Kas desa*), used for sugarcane plantations in 1994. In this village, the distribution of *sawah* land indicates that most farmers owned tiny plots of *sawah* between 0.025-0.125 hectare (See Table 3.3). More than five hectares of *sawah* land are owned by non- farmers in the

village and farmers who live in neighbouring villages. This table indicates that the size of land ownership is very small due to the population growth and land fragmentation.

Homegardens played an important role in the peasant household economy before the Green Revolution (GR) era was established in the 1970s. Several studies on homegarden (*pekarangan*) in Java described the important role of this type of agriculture both in terms of the ecological balance of the rural environment and the economic strategies among the peasants (Stoler, 1982; Penny and Singarimbun, 1973; Penny and Ginting, 1984). Such homegardens continue to be important in Tirtomulyo. In 1994, the total area of settlements was 151 hectares, of which 19 hectares was used for housing including pens, and 132 hectares for homegardens (*pekarangan*). Almost every household has *pekarangan* land. The average being about 1,300 m^2, but like that of *sawah* land, the distribution of *pekarangan* land is not equal. Most households own *pekarangan* land of less than 350 m^2.

Before the GR era, farmers used their homegardens for multiple purposes not only to produce coconut and banana, but also wood and fruit trees. Coconut was the most important plant in the homegardens. In Sriharjo, Bantul and some villages of Central Java, *pekarangan* also gave higher economic advantage than *sawah* (Penny and Ginting, 1984:3). The economic role of coconut sugar production in Tirtomulyo seems similar to its role in Sriharjo (Penny and Singarimbun, 1973), but in Tirtomulyo the exploitation of homegardens to produce coconut sugar was a rational decision of farmers to utilise their environment to increase their income. Low and unstable *sawah* production before

the GR frustrated farmers managing *sawah* land with the aim of achieving food security. On the other hand, by producing coconut sugar they were able to utilise their resources more productively with low labour input and little cost, and with a high stability in production as well as a higher price.

Coconut sugar production dropped steadily as a result of the strengthening of the GR in Tirtomulyo. Farmers now expect better production from their *sawah*. They also realise that the productivity of *pekarangan* cannot be increased by intensification. In addition, *pekarangan* plots are becoming smaller because of increasing housing. Households that have *pekarangan* land of around 350 m^2 most often utilise a half of that for a homegarden with four to six coconut trees. These trees cannot be expected to produce sustainable coconut sap everyday.

At present, homegardens in Tirtomulyo are utilised intensively. Most farmers prefer to cultivate coconut for its copra without aiming for sugar production. They also like to plant bananas which give yields every month. Almost all banana plants respond well to the use of manure from the dung of their chickens and livestock.

Another source of income for farmers is poultry and livestock raising. Almost all households keep around 5 to 10 head of chicken, some of which may be consumed at home. Unlike chickens, cattle and small ruminants are never used for consumption. The percentage of households that keep cattle is relatively high. In 1974 approximately 26 percent of all households kept cattle and this increased to 44 per cent in 1994. This increase indicates that cattle raising has become an important income source in the village during the last 20 years.

The third secondary income source is non-farm employment. In 1994, 16.3 per cent of all households had primary occupations beyond the agricultural sector (See Table 3.2), and 28 per cent of the total labour force worked outside agriculture (See Table 3.1).

The types of economic strategies among the 15 hamlets can be divided into three categories. First, there are the hamlets that stress *sawah* as their main economic activity. These hamlets are nine in number: Plesan, Paliyan, Gondangan, Karen, Karangweru, Jebukan, Genting, Jetis and Soropadan. Second, there are the hamlets which stress *sawah* and coconut sugar production. These hamlets are Tluren, Tokolan and Gaten. Third are the hamlets which stress *sawah* and non-farm employment. These hamlets are Punduhan, Bracan and Kergan.

People in the first nine hamlets stress *sawah* agriculture alone because their *pekarangan* land is not productive enough for coconut sugar. Nevertheless, they generally do not participate in non-farm employment because compared to the hamlet of Punduhan, Kergan and Bracan they have sufficient land.

Tokolan, Gaten and particularly Tluren developed a coconut sugar industry to support their income earning from *sawah* agriculture. Most are tiny and landless farmers and they have no reason to replace coconut sugar production with other economic activities because their coconut plants always produce sustainable sap. In addition, through their coconut sugar economy, these households have built an economic network with sugar traders who provide monetary loans when needed.

Table 3.4. Distribution of Household-Livestock Raisers in the Three Types of Hamlet Economy in Tirtomulyo 1994

No.	Hamlet Economic Types	Keep Cattle			Keep Small Ruminants		
		Number of House-holds	% All House-holds	Total Cattle	Number of House-holds	% All House-holds	Total Sheep/ Goats
1.	*Sawah* Agriculture (Nine Hamlets) N=943	513	54.4	854	43	0.04	137
2.	*Sawah* and Coconut Sugar Production (Three Hamlets) N=278	78	28.1	126	24	0.08	57
3.	*Sawah* and Non-Farm Employment (Three Hamlets) N=254	61	24.0	91	8	0.03	36
4.	Total N=1,475	652	44.0	1,061	75	0.05	230

Note 1. The number of cattle raisers includes three farmers who kept eight buffaloes.
2. Source: Primary data, 1994.

People in the hamlets of Punduhan, Bracan and Kergan looked to have additional income from non-farm activities, particularly outside the village. According to the hamlet leaders, there is not enough agricultural work for landless households. In these hamlets, much land is owned by outsiders, both from the village of Tirtomulyo and the villages in the sub-districts of Kretek and Sanden.

The differences in economic strategies among the hamlets of Tirtomulyo seem to bear a close relation to livestock raising (See Table 3.4). In the hamlets where *sawah* agriculture alone is stressed, the percentage of households keeping livestock is higher than in the hamlets with a mix of *sawah* agriculture and coconut sugar production, or non-farm employment; while the percentage of

households keeping animals in the hamlets of *sawah* and coconut sugar production is higher than in those of *sawah* and non-farm employment.

Villagers informed me that keeping cattle, coconut sugar production and non-farm employment cannot easily be integrated within a single household's activities. For example, cattle in Tluren may compete with coconut sugar production. Because of limited wood from the local homegardens, farmers in Tluren use rice straw for cooking coconut sap (*legen*). The time schedule for keeping cattle is the same as for producing sugar. Every morning, farmers who keep cattle must prepare feed and clean pens, and at the same time must tap *legen* from the palms and cook it in the kitchen. At noon farmers collect grass or possibly rice straw at the same time as they collect wood for firing the coconut sap. At sunset, they must tap *legen* again, while collecting fodder and preparing feed in the pens.

In those hamlets that include coconut sugar production, on the other hand, farmers can keep small ruminants. They still have time for tapping *legen*, and collecting wood to cook *legen*, as the task of collecting fodder and herding sheep can be given to their children.

Non-farm activities and livestock also cannot easily be integrated into a single household. Farmers working in non-farm employment tend to be unable to coordinate non-agricultural activities with livestock raising. Many non-farm workers who have jobs beyond the village under the control of employers usually work at least six hours and travel up to three hours daily. Hence they have no time for collecting fodder. Collecting fodder rice straw is considered too

physically demanding for women, and school hours make it impossible for younger male members of the households to compete for fodder.

3.4. The Green Revolution

The Green Revolution (GR) began in Tirtomulyo in early 1968. To some extent the changes in the agro-ecological *sawah* system of Tirtomulyo are similar to the changes in the whole of rural Java.

Soemardjo (1975:96) gave attention to the implementation of the GR in the Kretek sub-district including Tirtomulyo in 1974/1975. He found that with the rice intensification programme in this sub-district almost all the farmers adopted the new rice varieties and modern fertilisers. Variation in rice production among the farmers occurred, but this was not due to different access to packages of agricultural technology such as seed and fertilisers, but resulted from differences in land quality and irrigation (Soemardjo, 1975:112-113).

Table 3.5 indicates that rice and secondary crop production per hectare of *sawah* increased considerably during the GR era (1968-1994). The main crops were rice, soyabean and peanuts. Rice production per hectare from 1967 to 1994 increased by 130 per cent, and production of soyabean by 84 per cent, while the production of peanuts per hectare remained constant. These production increases in Tirtomulyo were due to the improvement of irrigation channels, the use of new seed, modern fertiliser and insecticide. The government rehabilitated the water channels that irrigated the *sawah* in this village and neighbouring villages in the mid-1970s.

This rehabilitation also resulted in increased area under rice with more than 90 per cent of *sawah* fields being able to be planted twice a year. Before this rehabilitation only 60 per cent of *sawah* land could be planted twice a year.

Table 3.5. Average Seasonal Rice and Secondary Crop Production Per Hectare in Tirtomulyo

No.	Crops	Average Production per Hectare of *Sawah* (In tonnes)				
		1958-1967	1974/1975	1979/1980	1993/1994	% Increase 1967-1994
1.	Rice	2.50	3.60	5.50	5.75	130.0
2.	Soyabean	0.70	0.80	1.08	1.29	84.0
3.	Peanut	0.80	0.90	0.74	0.90	12.5
4.	Maize	0.65	0.72	2.10	3.30	407.7
5.	Sweet Potato	5.00	6.00	5.50	15.28	205.6
6.	Cassava	7.00	5.00	11.20	11.24	60.6
7.	Chilli	-	-	-	8.0	-
8.	Onion	-	-	-	6.0	-

Sources: Figures in 1957-1967 and 1974/75 quoted from Soemardjo (1975:65,74), and the figures in 1979/1980 reflect the average crop production in the Bantul Regency which are quoted from Kantor Pusat Data Propinsi DIY (1981:182;201), and the figures of 1993/1994 from the village office and information from the village officials and farmers. Although not strictly comparable these are the best figures available.

The improvement of irrigation in Tirtomulyo did not permit farmers to plant rice three times a year. Rice is planted in the wet season (January to April), and *gadu* season (October to January). During the dry season (May-October), there is almost no available water in the village. As a result, farmers prefer to plant secondary crops.

Against the high production of the high yielding varieties (HYVs) of rice in the 1970s some of them had low resistance to brown planthopper, which caused production to decline at the national level and in the Bantul regency. As a

result, the government solved this problem by introducing new HYVs, such as IR 36, which have a high resistance to the planthopper and other insect pests (Se also Fox, 1991:69). From the early 1980s, farmers of Tirtomulyo began to plant this variety, and adopted as well IR 50 and IR 52 to replace PB 5 and Pelita which they had adopted in the early 1970s. Nowadays, IR 36 and IR 50 have become the dominant rice varieties in the village. The production of IR 36 in the village is approximately six tonnes per hectare, while IR 50 is 5.5 tonnes per hectare. IR 36 is planted in the wet season, while IR 50 is planted in the *gadu* season. In 1993, the average seasonal rice production in the Bantul Regency was 6.2 tonnes per hectare, while in the Yogyakarta province it was 5.3 tonnes per hectare (Biro Pusat Statistik DIY, 1994b:21, 35).

The rise of rice production per hectare in Tirtomulyo is related to the use of fertiliser rather than to any improvement in water irrigation. According to farmers the supply of water irrigation in the wet season at present is no different from what it was in the early GR before water channels had been rehabilitated. At present, there are no available data on the use of fertilisers in the village or in the sub-district of Kretek, except in Bantul and Yogyakarta overall. However, according to the officials and the traders of fertilisers, South Bantul, including this sub-district, consumes a higher proportion of fertilisers than North Bantul.

Table 3.6 shows the quantity of fertiliser for rice and secondary crops per hectare in Bantul and Yogyakarta in 1993. The main fertiliser for rice and secondary crops was urea. The table indicates that rice and secondary crops per hectare of *sawah* in Bantul used a higher quantity of urea than those in Yogyakarta overall. Greater use of fertiliser in Bantul would increase the supplies

of agricultural by-products and weed grass which becomes important cattle feed, as discussed in the chapter 5.

Table 3.6. Average Seasonal Quantity of Fertilisers Used Per Hectare of *Sawah* in Bantul and Yogyakarta, 1993 (In Kg.)

No.	Crops	Bantul			Yogyakarta		
		UREA	TSP	Others	UREA	TSP	Others
1.	Rice	299	129	20	255	88	16
2.	Soyabeans	37	22	5	34	33	2
3.	Peanuts	53	31	-	23	32	-
4.	Maize	72	12	-	70	13	-
5.	Cassava	49	21	8	36	22	-

Source: Biro Pusat Statistik DIY (1994b:21-40).

Since the early 1980s, because of the adoption of HYVs which are faster maturing varieties of rice, farmers have intensified their cropping pattern, and replaced some traditional secondary crops such as maize and sweet potato with others such as peanut, soyabean, onion and chilli which they consider more profitable.

At present, the general pattern of cultivation can be divided into three types based on the rice and secondary crops (*palawija*) intensification (Table 3.7). In the first, the rice is cultivated for two seasons and *palawija* for one season; in the second, paddy for one season and *palawija* for two. This second type can be divided into two sub-types, based on the main crops of *palawija*. The first crops are soyabeans and peanuts, and the second are chillies and onion.

The dominant choice of cultivation is pattern I. More than 225 hectares of *sawah* fields have available water in the *gadu* season, so that the paddy can be planted for two seasons. All hamlets in Tirtomulyo have *sawah* like this. Before

the water channels were rehabilitated in the early 1970s, many of these *sawah* fields were cultivated for rice for one season only. Instead, in dry and *gadu* seasons, soyabeans and peanuts were planted. Then the GR introduced IR 50 with a growing time of 85 days after transplanting, so this rice variety could be cultivated in the *gadu* season, harvested in the middle of January, and then the land cultivated again for rice. Before the GR era, after peanuts were harvested at the end of October, the *sawah* fields were left fallow in November and December.

Table 3.7. Pattern of *Sawah* Cultivation in Tirtomulyo

Patterns of Cultivation	Wet Season January-April	Dry Season May-October	*Gadu* Season October-January
Pattern I	Rice (IR 36)	*Palawija* -Soyabean, then peanuts	Rice (IR 50, IR 52, IR 64)
Pattern IIa	Rice (IR 36)	*Palawija* -Soyabean, then Peanuts	*Palawija* -Maize, plus Vegetable
Pattern IIb	Rice (IR 36)	*Palawija* -Onion, plus Chilli	*Palawija* -Chilli planted in the dry season

Source : Interviews with villagers, 1994.

Pattern IIa also appeared in the GR era. It is practised by farmers in all hamlets, particularly in the hamlets of Soropadan and Jetis, where most *sawah* fields lack a good water supply. This is an older pattern of cultivation than pattern IIb. There are about five hectares of *sawah* fields in Tirtomulyo that are cultivated using pattern IIa because of poor water supply in the *sawah* fields during the *gadu* season. This was the case both before and during the GR era.

Before the GR, these *sawah* were left fallow during the *gadu* to enrich fertility in the wet season. Nowadays, farmers recognise that the fallow system is less effective, and recognise that the productivity of the land depends largely on fertilisation. To enhance production, they plant maize and vegetables in the *gadu* season.

Pattern IIb has been evident in Tirtomulyo during the last 10 years. There are approximately 10 hectares of *sawah* fields cultivated according to this pattern. Several farmers had, in fact, planted onions and chillies 10 years ago, but these were only secondary crops of less importance than soyabeans and peanuts. Nowadays, many large and a small number of medium farmers prefer to cultivate onion and chillies rather than soyabeans and peanuts. They know that even though the cost and risk of failure of onion and chilli cropping is very high, the profit is triple that of paddy or peanuts and soyabeans. They have learned from the farmers in the Sanden sub-district and the Tirtohargo hamlet of Kretek who have had great success in farming onions and chillies. Most medium and small farmers and almost all tiny farmers, however, are not interested in farming these crops because they need much capital to provide inputs for production and they have a high risk of failure because of crop disease. In addition, they argue that their land is not suitable for them. They say that their land has a high clay content, meaning that sprayed water cannot go down to the roots of the plants.

One of the consequences of the GR is an increase in peasant welfare and a decline in the proportion of farmers who are unable to achieve food sufficiency. In the next chapter it will be shown that the rise of food sufficiency among farmers has affected the increasing popularity of livestock raising.

In delineating levels of poverty in Java, the most useful measure is kilograms of milled rice (Hart, 1978:101). The widely accepted level of income necessary to meet 'basic needs' in rural Java is 240 kg of milled rice equivalent per person per year (Penny and Singarimbun, 1973; Hart, 1978:101). Based on the rice yield per hectare which was 2.5 tonnes, in 1958-1967 small and tiny farmers of Tirtomulyo seemed to live below the 'poverty line'. The maximum land ownership of small farmers was 0.25 hectare of *sawah*. This land produced 850 kg of milled rice per year, and peanut or soyabean crops which were comparable with 212 kg of milled rice. With five household members, the small farmers who had their own land lived below the poverty line, each member having on average income equivalent to 212 kg of milled rice. Tiny farmers who held under 0.14 hectare of *sawah* lived in worse conditions.

In the 1960s small farmers who managed their own land were unable to achieve food self-sufficiency, but in 1974 they were able to achieve a small surplus in production. In 1974, when the production of rice per hectare was 3.5 tonnes, small farmers with 0.25 hectare of *sawah* produced 1,190 kg of milled rice per year, and secondary crops equivalent to 595 kg of *beras*. Using the standard of poverty these small farmers with their five household members, lived above the poverty line. In 1974, tiny farmers with landholdings below 0.13 hectare of *sawah* would have been categorised as below the poverty line, but by 1980 when the rice production per hectare reached five tonne tiny farmers who held 0.11 - 0.12 hectare of *sawah* achieved food sufficiency and even they had a small surplus in production. Nowadays, with the average rice production per hectare of 5.75 tonnes and production of soyabeans and peanuts reaching 1.29

tonnes and 0.90 tonnes per hectare respectively, tiny farmers who hold 0.09-0.10 hectare of *sawah* have achieved food sufficiency, and even they have a surplus from secondary crop cultivation.

Another consequence of the GR in rural Java is an increase in land accumulation among large farmers. With their surplus production they have better access to economic resources in their village than tiny farmers. My research in Tirtomulyo finds that the GR has enhanced peasant welfare, but it has not resulted in the situation of large farmers simply accumulating more land. This finding is similar to what Manning (1989:13-23) found in the macro data and Young (1988:124) found in the micro data, that the large farmers did not invest their production surplus only in agricultural land. In Tirtomulyo, progress in the intensification of rice and secondary crop production has given smaller farmers better control of their land. Before the GR was established in the village, small numbers of tiny farmers were forced to practise a 'safety first' strategy which consisted of selling or renting their land in order to meet their subsistence needs (See also Lyon, 1970:55).

The long-term impact of the rice intensification program in Tirtomulyo is very similar to that of the four villages of Bantul studied by Maurer (1991:93). In these villages, Maurer (1991:97) found that there is no real evidence of any strong land concentration or absolute impoverishment process; certainly rich landowners or village officials had prospered and were much better off than before, but poor landless families also benefited and were less destitute than in the past. In Tirtomulyo, there is no indication that the large farmers accumulated land from the tiny farmers. Conversely, many large farmers rent their land to the small

and tiny farmers. The ability of tiny farmers to rent land from large farmers stems from the keeping of livestock, to be discussed in chapter 4.

One reason that large farmers rent their land is because of limited labour for hire and a feeling that agricultural wages are expensive. All local village officers (27 people), including the village headman and heads of hamlets, rent out a part of their land to avoid the burden of agricultural costs. A local village officer explained:

> "Wage labour is expensive now. A male labourer receives Rp. 3,000 a day (*ndino*). Furthermore, many labourers tend to be lazy. They like waiting for snack time and lunch, and when they hear the sign for prayer (*adzan*), they finish their work. They like to work in other villages on chilli and onion cultivation, where they are paid a wage of about Rp. 5,000 a day. When we are angry about their attitudes, and control their work seriously, we are accused by the wage labourers of being stingy employers (*kemlanda-landa*) as in the colonial era."

Due to expensive labour and the high labour demand for the paddy and secondary crop farming, many large farmers prefer to farm about 0.3 to 0.5 hectare, and rent the remaining land to other villagers. Within that smaller area they can use their own household members rather than wage labourers.

One *ru* (14 square meters) is leased generally for Rp. 3,500 a year. According to the villagers, both the owners and the land tenants profit from this arrangements. One *ru* can be planted three times a year, and the rice yield of the first planting season can be used to pay for the cost of rent, the rice yield of the second for paying the cost of input production, and the *palawija* production of the third cultivation as the profit of land renting.

Nowadays, the local village officials (*pamong desa*) are considered by the villagers to be large-scale farmers. There are 27 village officers (including 15 hamlet leaders, who control more than 30 hectares of *sawah* lands (some of which is their own land, and the rest of which is *tanah lungguh* (the land for the 'salary' of village officers). However, all of them rent out land to the villagers. The rent price of *sawah* land as mentioned above indicates that they do not get a higher profit than the tenants. This differs from several research findings which indicate that by renting out or sharecropping their land to the small farmers, the large farmers obtain greater profits and more political support (Hart, 1986:101; Hüsken, 1989:322). In Tirtomulyo, the main aim of renting out land is not to make big profits but to obtain ready cash to finance their children's education in the cities, or to promote their children's careers in governmental offices, or to repay the loans used to obtain village staff positions.

Implementing the GR in Tirtomulyo has caused increasing agricultural commercialisation which has reduced labour absorption in rice and secondary crop harvesting, and changed the pattern of agricultural institutions, as well as the distribution of agricultural by-products which become cattle feed. These impacts of the GR will be discussed in Chapter 5. To some extent, the impact of these changes support Collier's argument (1979:1-43) against Geertz's assertion (1963:32-35) that the *sawah* continue to be able to absorb more people without reducing productivity, and the adaptability of Javanese farmers continue to share rice production practices under the conditions of increasing population pressure. The available qualitative data from Tirtomulyo show that increasing rice production per unit of land was followed by a reduction in labour absorption,

especially in after-harvesting activities. In managing rice farming, farmers did not maintain socio-economic solidarity, which would have allowed income sharing practices, but instead they acted to gain greater profits.

3.5. Summary

The long-term implementation of GR in Tirtomulyo has affected the village economy. Most farmers depend for their livelihood on a tiny plot of *sawah* land to produce subsistence and cash crops. Before the GR, most small and tiny farmers lived in destitution due to the low productivity of the *sawah*. The intensive farming system under GR has allowed all of the small and most tiny farmers to achieve food sufficiency. Meanwhile, medium and large farmers have gained considerable surplus of production, but it is not used for accumulating landholdings. Their profits in agriculture are invested in chilli and onion cultivation which have higher economic advantages than rice. However, many of the medium and large farmers are interested in investment outside agriculture and are forced to rent out their land to the smaller farmers.

The long-term implementation of GR changed the pattern of subsistence strategies among farmers. Before the GR, coconut sugar production in homegardens was one of the best economic strategies for solving poverty. Nowadays, most farmers do not exploit homegardens for sugar but prefer to concentrate on *sawah* agriculture and cattle raising. The long-term exploitation of homegardens for producing sugar has lowered the production of coconut sap, but farmers still utilise homegardens for producing both coconut and banana fruits fertilised by the manure from cattle raising.

Coconut sugar exploitation has been replaced by cattle raised and by non-farm activities. An increase in peasant welfare has accompanied the growing numbers of cattle raisers. Meanwhile, the increasing need for non-farm employment is due to the lack of work opportunities in the agricultural sector among those villagers who have limited access to *sawah* land.

Chapter Four

THE IMPACT OF THE GREEN REVOLUTION ON THE DEVELOPMENT OF LIVESTOCK RAISING IN TIRTOMULYO

4.1. Increasing Popularity of Livestock Raising

The long-term implementation of GR has encouraged livestock raising. This can be best understood by exploring the development of livestock raising before the establishment of the GR which can be traced back to 1939 based on available information from the villagers. In 1939, buffalo and cattle were the most important animals and there were about an equal number of each. Large farmers usually owned buffalo or cattle which were raised primarily as plough animals. At that time, the number of large farmers was approximately 150[1]. There were also small ruminant breeders raising sheep and goats. By keeping small ruminants, farmers aimed to increase their household income and raise sufficient capital to buy cattle or buffalo. The number of small ruminant raisers was very low. According to my informants, the number of breeders in every hamlet was around three, thus the total number of breeders in the village was around 45[2].

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[1] There was no governmental statistical record of livestock in the village from 1939 to 1979. This livestock data were collected only from verbal information of the villagers. Some older informants were able to remember the pattern of livestock raising in 1939, when they were young. They reported that in the 1930s, after land reform was over, the number of large farmers was around 150, and these farmers usually kept cattle or buffaloes. There were also smaller farmers who kept cattle, but the number of those was very small. I estimate that the number of large ruminants in 1939 was at least 300 head. This rough estimation was based on the number of large farmers and the general size of herd which was around two head per farmer.

[2] According to informants the size of the flock of every breeder was around three head of sheep or goats. Based on the size of the flock, and the number of raisers, I estimate that the total number of animals in 1939 was at least 125 head and the maximum was 135 head.

Cattle and buffalo numbers declined during the Japanese occupation. In Tirtomulyo as in most villages of Java, food and clothing became very scarce and expensive. As a result, many people in Tirtomulyo ate cassava, because it was cheaper than rice. Also, they sometimes ate the leaves of the sweet potatoes (*lung*) and *kremah*, a kind of grass, both of which were usually used as feedstuffs. A few farmers were forced to sell their livestock to buy food and clothing. Furthermore, the Japanese established an oppressive regime taking cattle and buffalo by compelling farmers to exchange their old animals for *blaco*, a kind of cloth, which was monopolised by the Japanese troops.

During the independence struggle (1945-1949) and post independence period (1950-1959), the cattle population in Tirtomulyo increased even though in Yogyakarta as a whole during the years 1953-1956 the number of cattle declined, because an increasing amount of grass land was being used for food crops and house sites (Soemardjan, 1962:242). Farmers found yearlings in market at a relatively low price as a result of recurring famine in Gunung Kidul. A trader of livestock in Tirtomulyo reported that in those years he went to Gunung Kidul every five days, and brought five to ten head of cattle from this upland area to his village. The price of one calf (*pedet)* was equal to 250 kg of milled rice. He sold the cattle to the people in Tirtomulyo and other villages in South Bantul and to the livestock markets in Yogyakarta and Bantul.

During the 1950s the development of livestock in Tirtomulyo was similar to its development in Yogyakarta overall, in the sense that farmers began to utilise livestock more profitably. Farmers who owned large land areas liked to have cattle or buffalo for ploughing their land but they also chose to sell and buy them when it was profitable (Soemardjan, 1962:2). Farmers increasingly preferred

cattle to buffalo because the price of a buffalo was lower. One head of cattle in 1958 was worth Rp. 5,000, whilst one head of buffalo was worth Rp. 3,000 (Soemardjan, 1962:251).

In the 1960s, during the "Old Order" (1959-1967), the development of livestock raising was relatively static in the sense that there was no increase in the number of raisers[3] due to the stagnating national economy. Most small and tiny farmers were unable to buy cattle. In addition, the cattle raisers, except the large farmers, used their animals to solve the immediate problem of survival, and a small number of them had no capital to buy new cattle after they had sold their stock to cover their demands for daily household consumption. Most small and tiny farmers were also faced with insufficient rice production because at that time one hectare of *sawah* only produced 2.5 tonne of unhusked rice (Soemardjo, 1975:79). Also the supply of rice in markets was limited and it was relatively expensive. In 1966 the rice prices increased more than three fold (Timmer, 1981:37). The government could not improve economic welfare in rural areas (Timmer, 1981:36). Conflict between political parties and the struggle to bring West Irian under Indonesian authority led to high inflation and the decline of economic productivity.

Although during the "Old Order" livestock breeding was stagnant, livestock and homegardens still offered the best strategies to overcome poverty. Many small and tiny farmers who produced coconut sugar, or kept livestock had additional income which could be used to avoid falling into the debt to money lenders. Some of them who kept cattle were able to use the profit to extend the

[3] Based on reports from the informants in each hamlet in Tirtomulyo in 1965 the total number of large ruminants was approximately 450 head, and small ruminants was 200 head.

size of their farm by renting land. The evident success of keeping livestock encouraged farmers to keep cattle as a mode of investment and saving.

> In 1961 Dollah married. He owned only 0.14 hectare of *sawah* inherited from his parents, and one bicycle which he bought by using his salary from his position in the village police during 1959-1960. He was doubtful about increasing his family income, but he noticed his neighbour's success in keeping cattle. In 1961 he sold his bike and the money was used to buy sheep, because it was not enough to buy cattle. In 1963, after he had enough capital he bought a buffalo. By keeping buffalo, he earned additional income through hiring the animals for ploughing. His income only became sufficient to feed his family after he rented 0.14 hectare of *sawah* by using the profit from keeping buffalo.

Changes in livestock raising have occurred since the implementation of the GR in the early 1970s. These changes are (1) a decline in buffalo population as a result of introducing hand tractors, and (2) an increase in the number of cattle raisers and cattle population resulting from the rise in peasant welfare.

Hand tractors spread all over Bantul in the 1980s. In Tirtomulyo, farmers began to use hand tractors in 1988. Now, there are four hand tractors which plough approximately 10 per cent of all *sawah* fields in the wet season. The main aim of keeping buffalo is to hire the animals for ploughing, therefore when the opportunities for leasing their animals declined, the raisers then bred cattle. Before hand tractors entered Tirtomulyo, there were roughly 20 people who kept buffaloes, but by 1994 the number of the raisers had declined to three people with eight head of buffalo.

Tractorization in Tirtomulyo also reduces the use of cattle for ploughing. Yet because the size of each landholding is relatively small, farmers who hold tiny plots of land do not require tractors or cattle and they prefer to use a hoe because

it is more efficient. Farmers call their cattle *sapi kereman* ("beef cattle") which stresses their value for offspring and for meat.

Table 4.1. Estimated Number of Cattle Raisers in Tirtomulyo

No.	Years	Households Raising Cattle	% All Households
1.	1994	649	44
2.	1993	620	43
3.	1992	601	42
4.	1991	588	42
5.	1990	573	38
6.	1989	523	38
7.	1988	475	34
8.	1987	427	31
9.	1985	400	30
10.	1979	350	28
11.	1974	300	26

Note: The estimations are based on reports of village residents and officials, and cattle population statistics (See foot note no 4). The figure for 1994, however, is not an estimation, but is based on my village survey.

A slight decline in the number of cattle for ploughing was accompanied, on the other hand, by an annual increase in the population of cattle. Table 4.1 shows that the number and percentage of households that keep cattle has increased over 20 years[4]. Based on the survey of this study, the number of cattle raisers in 1994 was 649 farmers with 1,053 head of cattle.

[4] Annual statistical data were insufficient to describe the growth of the livestock population in Tirtomulyo. The data did not reflect the real figures, but reflected the number of farm households that kept the animals. The sub-district officials only recorded the annual number of cattle according to the verbal reports of the village officers. In fact, the number of cattle that they recorded represents the number of farm households that kept the animals. This is because they usually only reported the number of households which were made to pay minimum animal tax. The households also preferred to report only one head to avoid paying tax for all of their animals. I argue, therefore, that in order to get reliable data about cattle raisers, it is better to use the statistical data on cattle population as a guide to estimating the cattle raiser numbers. This estimation was confirmed by verbal information from the villagers, especially the head of every hamlet who knew correctly every individual cattle raiser in the territory.

The increasing cattle population during 1974-1994 was associated with progress in peasant welfare due to the adoption of the GR. There are two reasons why the GR has encouraged the popularity of livestock raising. First, it has allowed farmers to achieve rice self-sufficiency so they do not depend on selling their cattle to buy food. Second, it has allowed peasants to attain surplus production which they use for economic investment including breeding cattle.

Food sufficiency is the basic concept for understanding the economic strategies of farmers in Southeast Asia (Belsky, 1993:131). In Tirtomulyo, because of rice production surplus, tiny farmers do not need to use their cattle to cover their food problem. Conversely, when there was insufficient food, farmers sold their cattle to provide food (Se also Huitema, 1982:298). In the mid-1970s, when the average rice production per hectare was 3.5 tonnes small farmers who managed their own land were able to achieve food sufficiency. By 1980, tiny farmers also had achieved food sufficiency because the rice production per hectare of *sawah* was more than five tonnes. Based on direct information from several small farmers, food sufficiency and indeed a small surplus affected the keeping of livestock. Farmers did not sell their cattle for buying food, or renting agricultural land, or meeting the demand of ritual ceremony costs. Conversely, they tried to buy cattle or sheep as a way of increasing their savings.

In the mid-1970s, many large and medium farmers began to spend their surplus production to buy luxury goods such as radios, tape recorders, and motor cars, but others used it for buying cattle. In the 1970s, for example, when most tiny farmers in rural areas lived in destitution, one young calf (*pedet*) was approximately comparable with 400 kg of *beras*, while in 1994 when most farmers lived in food sufficiency it was comparable with 588 kg of *beras*.

Increasingly access to cattle among medium and small farmers in the 1970s has allowed many tiny and landless farmers to keep cattle by practising shareholding. However by 1980 many tiny farmers had the capacity to buy cattle because the rice production per hectare had reached more than five tonnes. All tiny farmers who held 0.13 hectare of their own *sawah* had a small surplus production. They were able to harvest 1,144 kg of milled rice (*beras*) per year, and harvest secondary crops, which were equivalent to 572 kg of *beras*. Their surplus production was approximately 500 kg of *beras* which could be used to buy one young calf. In 1994, the rice production was 5.75 tonnes per hectare, providing better access to cattle through buying young calves at markets.

During the GR era, the number of small ruminant raisers has remained relatively stagnant. This was because keeping these animals for breeding was replaced by keeping cattle when the raisers had enough income to buy cattle. In 1994, the number of these farmers was 75 with animals numbering 230 head, consisting of 120 head of goats, and 110 head of sheep.

4.2. Livestock Ownership

4.2.1. Interest in Cattle

In the long-term implementation of the GR, classes of farmers have different interests in keeping cattle. Previously all farmers whether wealthy or poor had a strong interest in keeping livestock. Cattle and buffalo were a means of investment and were used as draft animals. However, because small farmers and landless villagers had no surplus income, only larger farmers owned livestock.

In Tirtomulyo, cattle and buffalo were previously owned by large and medium farmers, whilst small ruminants whether goats or sheep were mainly owned by tiny farmers. Tiny and landless farmers had opportunities to own large ruminants in two ways. First, they kept small ruminants until they had enough capital to buy a cow or buffalo. Second, they kept cattle or buffaloes through shareholding. The shareholding system *maro anak* means that when a cow had two calves, the shareholders could claim one of the calves. Before the 1960s many tiny and landless farmers depended heavily on shareholding in order to acquire cattle or buffaloes. In practising shareholding, many large farmers who owned cattle asked an additional duty of the shareholders which was to provide an offering (*srama*). A poor farmer reported his experience in 1972:

> "In the past, poor people were unable to own cattle. They had to keep cattle belonging to wealthy people. Nevertheless, at that time the wealthy people tended to exploit (*nindes*) poor people. When we wanted to keep their cattle, we had to *nyrama*, which was to give an offering to them. The offering was two cubic metres of sand. I still remember when Pak Kusen asked me to keep his cattle in 1972, after I had sold my own cattle to buy a bike. I refused his request because he asked me to carry out *nyrama*. I knew that *nyrama* at that time was not practised by people in Tirtomulyo."

In Tirtomulyo, *nyrama* within the cattle shareholding system disappeared by the end of the 1960s. This was due to the emergence of livestock traders and outsiders who leased their own cattle without asking for *srama*. In the hamlets of Soropadan and Karangweru, for example, since the 1950s there have been four traders from both inside and outside the hamlets who practised shareholding with tiny farmers. without *srama*. Furthermore, since the 1960s, there has been an

increasing consciousness among poor farmers who tended to avoid the shareholding practices of the large farmers who exploited them by asking *srama*[5].

Table 4.2. Number of Farmers Who Kept Cattle (Both Owned and Sharehold) 1994

No	Farmers	Number	Per cent
1.	Large Farmers	2	0.3
2.	Medium Farmers	96	14.8
3.	Small Farmers	189	29.1
4.	Tiny Farmers	314	48.4
5.	Landless Farmers	48	7.4
	Total	649	100

Source: Primary data, 1994.

Since the mid-1970s, the number of tiny farmers who keep cattle has increased steadily and since the early 1980s cattle shareholding has come to be a less important method of keeping animals by tiny farmers. Increasing numbers of tiny farmers with cattle has occurred alongside a decline in the large and medium farmers who keep animals. As a result, by 1994, tiny farmers who were the minority of cattle raisers before the 1980s had become the majority[6]. Table 4.2 shows that the number of tiny farmers in 1994 who keep cattle is almost four times that of medium and small farmers.

Keeping small ruminants has not changed basically because the raisers are tiny farmers, and there has been no change in the interest in keeping small ruminant among the villagers. Table 4.3 shows that farmers who keep small

[5] Perhaps, the reason for this was related to the control of the communist members over land shareholding practises. The village headman reported that the communists even forced him to stop his business in teak timber which they regarded as causing him to neglect his main duty as an officer.

[6] It must be stated that small farmers also have the potential to become cattle raisers, but since their total numbers are lower than tiny farmers they are not likely to be the majority cattle raisers.

ruminants are mainly tiny farmers, followed by landless farmers. Indeed, from August 1994 to September 1994, the number of raisers had increased from 54 to 78, and those were mainly small farmers. Partly the reason was that the government gave credit to the 24 farmers in the Jebukan hamlet of Tirtomulyo who built a collective pen[7]. When the 24 farmers received the small ruminant credit, they had been keeping cattle. They would not have been interested in keeping small ruminants if they had not been offered an incentive from the government.

Table 4.3. Number of Farmers Who Kept Small Ruminants in 1994

No.	Farmers	Number	Per cent
1.	Large Farmers	-	-
2.	Medium Farmers	1	1.9
3.	Small Farmers	7	12.9
4.	Tiny Farmers	31	57.4
5.	Landless Farmers	15	27.8
	Total	54	100

Note: 1. Source: Primary data, 1994.
2. The number of small ruminant raisers does not include the 24 farmers who became the members of the collective pen, and they keep small ruminants together with cattle.

Further analysis of cattle ownership is intended to examine the reasons why almost all large farmers and a small number of medium farmers do not keep cattle although they have better access to providing capital and feedstuffs. Scott (1976:57) argues that the commercialisation of agriculture increases the variability of income amongst farmers. This study shows that agricultural

[7] This collective pen was built in the village office land. The idea of a collective pen is to avoid dung pollution around house yards. Therefore, by building a collective pen, farmers moved their pens from their house yard to the collective pen in the *sawah* area. The government then gave small ruminant credit to the members of the collective pen. However, most farmers do not like to have collective pens. With individual pens in their house yards, they can look after their animals more efficiently.

commercialisation has made large farmers and a small number of medium farmers pay more attention to new market bases for their source of income. In general, they differ from the small and tiny farmers regarding their views of cattle as a means of household economic strategy. Large farmers perceive it as uneconomic to keep cattle. They like to allocate their capital and working time to cash crops and non-agricultural activities which they consider give higher profit than keeping cattle. By planting chillies and onions they have gained a higher profit than keeping cattle. The annual profit on a single head around Rp. 500,000. In Kretek, on average, one hectare of *sawah* in the dry and *gadu* seasons produces eight tonnes of chillies and six tonnes of onion. In 1994, the price of one kg of chillies was Rp. 3,000, and one kg of onions was Rp. 1,000. By planting 0.33 hectare of chillies and onions, the farmers gain a net profit of at least Rp. 7,200,000.

Second, many large farmers have non-agricultural income. Their household members work in village offices or the governmental sector which means they are unable to devote time to collecting grass. Finally, some argue that the 'era' has changed since no one likes to be *pekathik*, persons who are 'hired' to keep cattle. The *pekathik* were usually poor people. The *pekathik* ate and slept in the households of their patrons. They had no set salary in terms of money, but their patrons had the duty to look after them and gave them something when they married or retired. Nowadays, no parent would ask their children to become *pekathik*. They prefer to send their children to school.

Unlike most large farmers, a small number of medium farmers who do not keep cattle are still interested in cattle raising. However, some do not have cattle because they are forced to use their capital to meet the urgent demands of

financing educational costs. Their children study at high schools, and some study at universities.

In the village there are some medium farmers who used to keep cattle, but they lost interest in keeping the animals after they were able to meet the consumer demands of modern lifestyles. They used their capital and profit to buy motor cars and build modern houses. There are some medium farmers who also used to became keep cattle until they had success in cultivating onion and chillies. In South Bantul, these crops have become important crops in the last five years because of the high market price. The price of chillies went up from Rp. 1,000 per kg in 1991 to Rp. 3,000 per kg in 1992. As a result, many medium farmers suddenly became wealthy families[8]. An informant explained that cattle are an unattractive investment for medium farmers.

> "People in this hamlet like Bambang could buy cattle; he could even buy two head of cattle at once. It is because his chilli and onions yields were 300 *ru*, while the price of chilli was Rp. 3,000 per kg last year. He explained that he did not know what to do with his money. After many people saved their money in Indonesian People's Bank (Bank Rakyat Indonesia) in Sanden, this bank refused to accept deposits from the people in South Bantul. Some of them and Bambang as well then spent their money by buying a Honda (motorbike). He did not buy cattle. Chillies and onions give better income than cattle. There were difficulties in keeping cattle, because both chillies and onion need high labour input and must be tended everyday."

On the other hand, the small, tiny farmers, and landless farmers regard cattle as important to their economic wellbeing (See next section). Unlike large and medium farmers only a few small and tiny farmers plant chillies and onions because they are unable to finance the production cost. They are worried about

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[8] Many farmers in Kretek and Sanden of South Bantul spent their profit on motorbikes, renovations to their houses, or put the profit in the bank.

the harvesting failure of these crops which would leave them unable to sustain their daily consumption. Soyabeans and peanuts are preferred crops since they produce stable profits and do not require high input production costs although the profits are lower than for chillies and onions. In other words, they live near the subsistence level and hence practice a safety first principle which means they prefer to minimise the probability of having a disaster rather than maximising their average return (Scott, 1976:18).

Generally speaking, small and particularly tiny and landless farmers regard cattle as the best means of investment, savings, economic assurance and household economic mobility. Almost all tiny farmers realised that they had to work hard to own cattle. They saved their income little by little, and after several years they were able to buy cattle. Without savings through reducing their household consumption, they were unable to provide the capital. A small number of tiny farmers bought cattle by pooling capital with their neighbours and relatives. The landless farmers had to work harder than tiny farmers and lived more modestly in order to buy cattle. Nevertheless, most of them were still unable to afford cattle.

Nowadays, there are more than 280 small and tiny farmers who do not keep cattle. According to villagers they have no cattle for several reasons. First, they may have no adult male household member to care for the animals everyday. Second, their male members are too aged and unable to collect grass or rice straw and look after the animal. Third, they may not have enough capital to buy cattle. Fourth, there may be no one who has offered them the possibilities of cattle shareholding. Fifth, their income may have been exhausted on other urgent things

such as hospital expenses, housing construction and other urgent demands. Sixth, their house yard may not be large enough for cattle pens.

4.2.2. Access to Cattle

Hart (1978:107) found that the distribution of secondary asset in terms of livestock is somewhat more equitable than that of rice land, but was clearly closely related to control over rice land. This study points out that the GR increased access to cattle among tiny farmers, but it did not change the structure of cattle ownership systems.

Table 4.4. Percentage by Classes of Farmers Who Kept Cattle in 1994

Keep Cattle or No Cattle	Medium Farmers	Small Farmers	Tiny Farmers	Landless Farmers
Kept Cattle	79.5	81.5	48.4	23.8
No cattle	21.5	19.5	51.6	76.2
Total	100.0 (N=127)	100.0 (N=233)	100.0 (N=651)	100.0 (N=202)

Source: Primary data, 1994.

Access to cattle depends on the capacity to breed animals, own animals and lease animals in shareholding practices. In 1994, based on my research the percentage of the smallest farmers who keep cattle was lower than that of the largest farmers[9] (See Table 4.4).

It is clear that medium and small farmers have a greater capacity to own cattle than others. Table 4.5 shows that the percentage of medium farmers who

[9] In this table the two large farmers who keep cattle are included, but not shown separately. Because there are only two, and the average number of their own cattle is only two head each, they are included in the category of medium farmers. Also, this table and the following tables include the three farmers who keep eight head of buffalo among themselves. This is because their numbers are small and the capital needed to own buffalo is similar to cattle.

keep their own cattle is higher than that of tiny and landless farmers. Cattle shareholding is, however, important among the landless farmers. More than 56 per cent of them practised cattle shareholding (Table 4.5). Also, it is evident that medium farmers own a greater number of cattle than smaller farmers (See Table 4.6). They have the capital to buy cattle. Nevertheless, like other farmers, most medium farmers tend to own only one or two head of cattle because of the problems in obtaining feedstuffs (See husbandry section and Chapter 5).

Table 4.5. Status of Cattle Ownership among Farmers in 1994

No.	Status of Cattle Ownership	Medium Farmers	Small Farmers	Tiny Farmers	Landless Farmers
1.	Owned by themselves	91.8	84.7	76.4	43.3
2.	Owned by others or Shareholding	7.2	15.3	23.6	56.7
	Total	100.0 (N=99)	100.0 (N=190)	100.0 (N=315)	100.0 (N=48)

Source: Primary data, 1994.

In shareholding cattle, medium farmers are also in a better position than the smaller farmers. Indeed, cattle shareholding is not common in Tirtomulyo at present, but those who own the cattle are mainly medium farmers. In 1994, there were 42 out of 649 farmers[10] who kept cattle but also leased their own cattle to the shareholders (*penggaduh*). A majority of the group of 42 farmers were medium farmers who leased their cattle to the tiny and landless farmers. The rest were those small and tiny farmers who leased their own cattle to other tiny and landless farmers.

[10] There were also 33 people who leased their own cattle but did not keep cattle. These data were obtained from interviews with respective hamlet leaders. In 1994, the government also owned more than 500 head of cattle which were leased to the Bantul villagers. In Tirtomulyo, there were three people who leased cattle from the government.

Table 4.6. Number of Cattle Owned by Farmers in 1994

No.	Number of Cattle	Medium Farmer	Small Farmer	Tiny Farmer	Landless Farmer
1.	One	27.8	44.4	58.3	47.6
2.	Two	46.7	44.4	37.5	47.6
3.	Three	18.9	8.8	4.2	4.8
4.	Four to Five	6.7	2.5	-	
	Total	100 (N=90)	100 (N=161)	100 (N=240)	100 (N=21)

Source: Primary data 1994.

4.3. The Importance of Livestock Income

Increased cattle raising during the GR has made livestock an important peasant livelihood in Tirtomulyo. Generally speaking, peasant livelihood in Tirtomulyo derives from agriculture, but this is combined with livestock raising. In this village, more than 48 per cent of the households in 1994 had some income from keeping livestock. Meanwhile, although more than 52 per cent of the households do not keep livestock, 58 per cent of those households still received an additional income from the livestock sector. They exchanged their crop by-products for the labour of cattle raisers who worked in the harvest of their crops.

Table 4.7 shows the general pattern of cattle income from keeping one cow per year without regard to labour cost[11]. Indeed, most cattle raisers in this village do not take into account the cost-benefit of keeping cattle in terms of labour allocation and feeding costs which is covered by non-monetary expenditures. The income from cattle raising therefore is no different among the classes of farmers. However, the incomes from rice and secondary crops

[11] What I mean by general pattern of cattle income is profit from cattle breeding, not fattening. Although on average medium farmers keep two head of cattle, they usually keep a cow and her calf. Profit is computed using local knowledge, in which the raisers do not take into account their working time, in particular the time allocated to collect fodder everyday.

(soyabeans and peanuts only) differ among the farmers due to the unequal landholding. Table 4.7 shows that the proportion of income from cattle is highest among the tiny farmers, more than 37 per cent of their total household income.

Table 4.7. Estimated General Pattern of Net Household Incomes according to Categories of Farmers, 1994

No.	Sources of Household Incomes	Medium Farmers	Small Farmers	Tiny Farmers
1.	*Sawah*			
	a. Rice Crop	56.2	51.9	42.5
	b. Secondary Crops	29.6	24.9	20.4
2.	Cattle	14.2	23.2	37.1
	Total	100.0	100.0	100.0
		Rp. 3,516,102	Rp. 2,155,435	Rp. 1,349,734

Notes: 1. On average, the landholding of the medium farmers was 0.33 hectare, the small farmers 0.17 hectare and of tiny farmers 0.09 hectare.
2. The secondary crops are soyabean and peanut.
3. Source: Primary data, 1994.

Although the income from livestock is lower than from *sawah*, livestock income occupies an important economic function, particularly among the small, and more particularly among the tiny and landless farmers. People said that without livestock they could not improve their welfare, insure their economic life, nor increase their social and economic status. They even think that God blesses farmers who keep cattle, so that they can achieve economic progress. Ijan, a farmer, explained:

> "Perhaps it is right what Hindus believe that cattle entail a peaceful life. Please look at one of my relatives. He can live well by keeping cattle. All of his sons and daughters have become teachers and civil servants. Cattle enable him to solve his problem. By persevering in keeping cattle, he was allowed by God to fulfil his earning. The contrast is my relatives, who seek money as traders and civil servants. They cannot manage households or families. Their children are not a success in life, and they always have debt."

This farmer's point of view implicitly indicates the importance of cattle as a means to increase income and develop a saving attitude which allows the raisers to enhance their wellbeing. His two relatives are not successful because their salary income does not promote savings so they are not able to enhance their economic mobilisation. Keeping cattle requires long-term saving, because farmers usually sell their cattle after they are successful in breeding cows. Generally, they do not pay special attention to the breeding of their animals because they consider there are no ecological risks in terms of disease.

As a means of saving and of social and economic mobility, cattle are suitable for tiny and landless farmers because they can obtain cows through shareholding, and provide feedstuffs without using land and capital. Among tiny farmers and landless farmers, cattle shareholding is better than renting land. When renting land, farmers must pay the cost of renting, as well as being faced with a high risk of failure in cultivating crops.

Clearly cattle provide the most important means for enhancing social and economic welfare, while goats and sheep are suitable for financing small monetary needs, including daily food consumption. Because they are valuable property, cattle can be expected to be used for highly priced goods or services such as rehabilitating and developing houses, renting and buying land, and funding high school and university education.

As a means of economic mobility, cattle are superior to coconut sugar production which is an important household income in the hamlets of Tluren, Tokolan and Gaten. Coconut sugar production permits farm households to have a daily income. At present, depending on the number of coconut plants and the intensity of tapping, each farm household producing coconut sugar is able to earn

Rp. 1,000 to Rp. 5,000 per day. This can be used not only for daily consumption, but also for saving. However, income from coconut sugar is unstable due to the fluctuating price of sugar. Furthermore, as the people of Tirtomulyo mentioned, farmers are often unable to save their money from coconut sugar because they are always faced with unpredictable daily consumption, for instance spending their money to support ritual ceremonies in their communities. Conversely, cattle have stable prices and this facilitates the owners to save their income over the long-term for use whenever they need to make a new investment either social or economic which requires a high monetary demand.

This study reveals that although tiny farmers gained fewer advantages from rice and secondary crop intensification, they have an opportunity to enhance their welfare through keeping livestock. Most tiny farmers who have cattle assert that the progress of their household economy depends on their success in breeding animals. By using cattle, some have had the opportunity to buy a small plot of land[12] when land auctions (*ceplik*)[13] occur. Cattle give them the capacity to rent land, to rehabilitate or to build houses, and to finance their children's education in high school or universities. The price of renting land is Rp. 3,500 to Rp. 4,000 per 14 m^2 (one *ru*) per year. From fieldwork, some direct information was obtained that illustrates the importance of livestock to strengthen the economic basis of tiny farmers both inside and outside agriculture:

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[12] According to the village headman, the price of land per m^2 was around Rp. 10,000 in 1994. By selling one head of cattle, tiny farmers were able to buy a piece of land of around 180 m^2.

[13] Land auctions sometimes occurred in the village because people inherited land from their parents, but they were forced to sell to their relatives or neighbours. First, this is because they lived in the areas far from the village. Second, a number of heirs received a single tiny plot of land, and they preferred to sell this land as farming would have been both impractical and inefficient.

"Krama, a person of my hamlet, is better than me (the head of Hamlet). He was a landless farmer, but now he has 40 *ru* of *sawah* from keeping cattle. He initially carried out shareholding cattle, owned by Pak Madi, a cattle trader. Now, he has built four houses for his sons. The money came from keeping cattle for 25 years."

"Two years ago my brother visited me. He lived as a transmigrant in Sumatra. He asked me to buy his inherited land of 35 *ru*. I pay in instalments every year by selling cattle."

"This year there are five people in my hamlet who sold their cattle for their children's enrolment in police education. Three of them have been accepted to study in the police institute."

Farmers who keep livestock more than one year usually gain a profit from their animals and use it for many purposes. Table 4.8. shows that the main benefit of cattle raising is for economic and social investment. Conversely, the main

Table 4.8. Main Utilisation of Livestock Income

Main Utilisation of Livestock Income	Cattle (N=624)		Small Ruminants (N=54)	
A. Economic Investment	38.0		17.0	
1. Renting in *sawah* land		14.3		4.3
2. Buying *sawah* land		23.7		12.7
B. Social Investment	37.0		14.9	
1. Financing children education		21.0		12.8
2. Rehabilitating and building houses		11.0		2.1
3. Financing children to get jobs		5.0		-
C. Household Consumption	25.0		68.1	
1. Financing daily Consumption		20.4		59.6
2. Financing ritual ceremonies		2.2		8.5
3. Buying luxury goods		2.4		-
Total	100.0		100.0	

Note: 1. This table only includes the households that were successful in keeping cattle, or small ruminants.
2. Source: Primary data, 1994.

benefit of small ruminant raising is for household consumption. In relation to economic investment, those who rented or bought *sawah* land were mainly small and tiny farmers, while those who used their income to get their children's jobs

were the medium farmers. It is a common phenomenon in Tirtomulyo that many young people like to work in the formal and governmental sectors. Nevertheless, to do this they need money, and their parents either sell cattle, or rent out their land to obtain the money for their enrolment in governmental jobs.

4.4. Livestock Husbandry

The previous section concluded that the rise of peasant welfare has increased the capacity of farmers to own cattle and has changed the interest of farmers in cattle raising. This section analyses to what extent the long-term implementation of GR affected the patterns of livestock husbandry. Several aspects of animal husbandry will be discussed in this section: (1) the kinds and qualities of the animals, (2) the pattern of small-scale livestock production, (3) the production strategies, and (4) feed resources.

Farmers recognise that keeping cattle requires more capital than buffalo or small ruminants and keeping small ruminants is more immediately profitable than cattle. As a comparison, to raise one head of cattle, farmers need at least Rp. 600,000 of which Rp. 500,000 is used to buy a young calf and Rp. 100,000 is used to build a cattle pen. For keeping a buffalo, farmers require only Rp. 500,000 because the price of buffalo is lower than cattle. The capital for keeping cattle can be used to buy three head of sheep or goats and to build a pen. After one year the profit received by farmers from keeping the cattle is approximately Rp. 400,000, the buffalo Rp. 300,000 and the small ruminants Rp. 650,000. Nevertheless, farmers prefer to keep cattle because these animals are more adaptive to the local feed resources, and the GR has been able to increase the supplies of feed.

According to the farmers buffaloes like to eat rice straw which is relatively abundant in the village, but these animals eat more feedstuffs compared to cattle. Goats and sheep do not like to eat rice straw and secondary crop by-products. While goats only eat grass and green leaves (*ramban*), sheep only like to eat grass. However, the supply of grass is very limited in the village, and there are increasingly fewer *ramban* as a result of intensifying homegarden utilisation (See Chapter 3). Ideally, sheep and buffalo should be herded, but many farmers are unable to devote time everyday to herding them because of the demands for their agricultural activities. In addition, there is no available land for herding except for the road side where many grass cutters also compete for this road-side grass.

As the basis of improving the quality of cattle, farmers have adopted the high quality cattle introduced by the government since the 1970s. The government also encourages farmers to mate their local cattle with high quality Brahmana, Ongole, and Simental by providing the semen of these species and an artificial insemination program. Some farmers have adopted artificial insemination and hence cattle in rural areas are not only Javanese breeds but also crossbreeds (*Jawa campuran/ Segon*). Ongole, Simental and Brahmana crossbreeds are larger than Javanese cattle.

During the GR era, farmers of Tirtomulyo adopted crossbreeds of Javanese and Ongole by buying in the markets rather than by adopting the artificial insemination method. Now, almost all cattle in the village are crossbreeds of Javanese and Ongole, but these cattle are still more Javanese than Ongole breeds. Based on information from officials, it is estimated that the rate of use of artificial insemination in Yogyakarta overall was 20 per cent in 1987. In

Tirtomulyo only 25 farmers have been using this technique; and of the 360 head of mature cows only nine per cent were artificially inseminated in 1993/1994. The government does, in fact, subsidise artificial insemination programs by giving accommodation and incentives to the inseminators, and by providing semen at a lower price, not more than Rp. 5,000 per insemination. However, the inseminators sometimes commercialise their services. The total cost can then increase to Rp. 15,000. This cost can even double because there is a high failure rate in artificial semination in Yogyakarta resulting in cows needing two lots of artificial insemination to become pregnant.

In Tirtomulyo and in Yogyakarta overall, the failure rate of natural mating is high too. It is estimated that on average a cow becomes pregnant after mating naturally three times. In general, the owners of cows only pay to the bull's owners once though the mating may be carried out more than once. The cost of natural mating is about Rp. 5,000 and it can be paid on credit.

Another reason why farmers do not like artificial insemination is because they recognise that Javanese cows have difficulty bearing the calves of Ongole, Simental or Brahmana breeds. This occurs because Javanese cows have small bodies and narrow vaginas. Farmers have experienced many problems in helping their cows to bear the big calves of artificial insemination. Often the aid of a veterinary assistant (*mantri ternak*) is needed. Unfortunately such veterinary assistants are often unavailable because they are working in other villages.

With regard to the size of herd and flock, it can be concluded that livestock raising in Tirtomulyo is a small scale production. In 1994, the average herd size was 1.6 head of cattle. Meanwhile, the average flock size was 3 head of sheep or goats, and the mode size of flock was 2 head.

The size of the herd reflects the capacity of farm households to provide for feedstuffs. Table 4.9 shows that on average larger farmers keep a higher number of cattle than smaller farmers. However, generally most farmers whether medium or tiny farmers usually keep between one and two head of cattle. Keeping one or two head of cattle requires at least three hours everyday collecting grass or rice straw while they work in their own *sawah*; many of them must work as hired labourers. This study did not collect household time allocation data in detail, but the general pattern of household time allocation in Tirtomulyo seems to be similar to the pattern in Kaliloro, Yogyakarta. An individual in Kaliloro worked hard everyday with several activities in a single day (White, 1982:140). By keeping more than two head of cattle, the raisers would find it difficult to provide adequate feed. Furthermore, they are faced with the fluctuation in seasonal feed supply, and insufficient grass feed in the village. All of this prompts them to keep only one or two head of cattle.

Table. 4.9. Distribution of Herd Size according to the Class of Farmer, 1994

No.	The Size of Herd	Medium Farmers	Small Farmers	Tiny Farmers	Landless Farmers
1.	One	30.3	47.4	55.9	56.3
2.	Two	42.4	43.6	37.5	41.7
3.	Three	20.2	7.9	6.0	2.0
4.	Four to Five	6.1	1.1	0.6	-
	Total	100.0 (N=99)	100.0 (N=190)	100.0 (N=315)	100.0 (N=48)
	Average	2.0	1.7	1.5	1.5

Notes 1. Source: Primary data, 1994.
2. The herd included both cattle owned by the farmers or others.

Farmers prefer to keep cows for breeding rather than bulls for fattening (See Table 4.10). Most farmers do not like fattening because this requires more

capital to buy good bulls which consume rice bran and other feed. Farmers argue that the good bulls are those of the Ongole breed, or at least crossbreeds of Javanese and Ongole breeds where the Ongole element is dominant. The bulls only grow fat because they are responsive to feed concentrates. Nevertheless, bulls are expensive. In 1994, one Ongole calf cost Rp. 900,000 while the Javanese breeding was priced at Rp. 500,000.

In Tirtomulyo, the increase in fattening is mainly caused by the increasing cattle population in the village which has made green feed more scarce. By keeping bulls, farmers can reduce the demand for green feed, because bulls eat less grass than cows. Table. 4.10 shows that there is no clear relation between categories of farmers and cattle fattening practices. The decision to practise cattle fattening is the result of individual perceptions of the importance of bulls to reduce green feed consumption rather than the farmers' capacity to purchase stock.

Table 4.10. Distribution of Cattle Raisers according to the Production Strategies, 1994

No.	Animal Production Strategies	Medium Farmers	Small Farmers	Tiny Farmers	Landless Farmers
1.	Breeding	82.3	86.8	82.2	85.4
2.	Fattening	17.7	13.2	17.8	14.6
	Total	100.0 (N=99)	100.0 (N=190)	100.0 (N=315)	100.0 (N=48)

Source: Primary data, 1994.

A final aspect of livestock husbandry is the feeding system. During the GR the main cattle feed were by-products such as rice straw, rice bran, and secondary crop by-products and wild grass. The changed attitudes of farmers toward these

by-products and their strategies to obtain them will be discussed in detail in the next chapter.

4.5. Summary

This chapter reveals that the long-term implementation of the GR has allowed farmers to achieve food sufficiency and to have surplus production. This enabled them to reformulate their economic strategies to maintain subsistence security and gained household economic mobility. The progress of economic welfare as a result of the GR and the increasing monetary economy in the village has resulted in different attitudes among farmers toward investing their incomes earning and adjusting their economic strategies. Large and medium farmers have wider investment choices than small and tiny farmers. Large farmers prefer to invest their surplus production in chillies and onions, the newest cash crops, which reap high economic benefits rather than conventional crops or livestock raising. Medium farmers are split into two groups, the larger ones are still concerned with cattle raising, while the smaller ones are interested in the newest cash crops which give immediate opportunities to enhance their income earnings.

Small and tiny farmers are strongly interested in cattle raising. The keeping of cattle for small and particularly for tiny farmers is an adaptive economic strategy to avoid living at subsistence level, and to create the possibility to raise above the subsistence livings. Cattle raising enables farmers to build economic security with long-term saving and investment which they can then utilise whenever they have the opportunities to strengthen their economic bases.

The fact that tiny farmers are so heavily involved in cattle raising demonstrates that the long-term implementation of GR has not hindered tiny

farmers from strengthening their economic base in the village. With cattle, they are able to maintain control of their land and some cases even to rent land. Nevertheless, even though they form a large percentage of the cattle raisers, they have less capacity to keep and own cattle than larger farmers. The evidence shows that the structure of cattle ownership remained unchanged in the sense that larger farmers own a larger number of cattle than smaller farmers.

The increase in peasant welfare and changes in the cattle ownership have not in general affected patterns of cattle husbandry. Farmers still prefer a small sized herd of one or two head of cattle. This is because livestock raising is done in conjunction with other household incomes. Farmers also preferred to practise livestock breeding rather than fattening, choosing a natural mating system rather than artificial insemination and utilising crop by-products and wild grass as the main source of feed. These animal husbandry strategies reflect the cost-benefit problems of farmers who have poor access to capital. Nevertheless, most of the Javanese cattle breeds have been replaced by cattle crossbreeds of Javanese and Ongole. Farmers have also changed their strategy in keeping cattle in that they have become more market oriented. Cattle are kept for producing offspring and for meat *(sapi kereman)*. Thus they have become more concerned with efforts to supply the market than to meet their own demand for draft animals. Furthermore, as discussed in the next chapter, farmers have changed their strategy for obtaining cattle feed in response to the increasing cattle population.

Chapter Five

THE IMPACT OF THE GREEN REVOLUTION ON THE LIVESTOCK FEEDING SYSTEM IN TIRTOMULYO

5.1. Introduction

As a small scale activity, the survival of cattle raising in Tirtomulyo depends upon the livestock feeding system which includes the sources and productivity of local resources to supply feed, the ways feed is distributed among the raisers and their strategies to obtain the feed. During the implementation of the GR, an increase in the number of cattle raising households and the emergence of tiny farmers as major cattle raisers has been followed by changes in the livestock feeding system.

The sources of cattle feed has remained unchanged during the implementation of the GR. Farmers depend heavily on crop by-products to feed their cattle. Nevertheless, the GR has changed the patterns of cattle feeding systems in terms of the *sawah* feedstuff productivity, the feedstuff distribution system and the ways cattle raisers obtain the feedstuffs.

Research findings in West Java argue that the implementation of the GR (1983-1988) enabled one hectare of *sawah* to support 3.8 head of cattle (Satari, 1975:13). In Tirtomulyo, before the GR (1967) the carrying capacity of one hectare of *sawah* was approximately 1.6 head of cattle, while during the GR (1994) it was 3.8 head of cattle (See Table 5.1). Nevertheless, in 1994, the cattle density per hectare of *sawah* in Tirtomulyo was roughly 4.4 head, thus exceeding the *sawah* carrying capacity. Moreover, the amount of green feed produced by the *sawah* in Tirtomulyo is relatively poor in meeting the demands of an

increasing cattle population. In the local feed system, green feed consists of wild grass and secondary crop by-products, while rice straw, which is relatively abundant in the village, is regarded as secondary feedstuff. The problems of limited green feed lead farmers to formulate adjustment strategies which affect the feed distribution in the village.

Table 5.1. Estimated Annual Cattle Feed Production Per Hectare of *Sawah* Before and During the GR Era

No.	Crop By-products and Wild Grass	Production of By-products (Kg)	
		Before the GR Era (1967)	During the GR Era (1994)
1.	Dry rice straw	10,800	26,780
2.	Secondary Crop By-products	6,690	13,380
3.	Wild Grass	1,681	4,367
	Total	19,171	44,527

Note:

1. My informants, Sulardi and the head of hamlet suggest that 32 kg of feed is the ideal consumption per head. This figure comprises 12 kg of dry rice straw and 20 kg of grass
2. This carrying capacity does not include the capacity of *sawah* to produce rice bran.
3. The annual production of all crop by-products per hectare in 1967 was collected from in-depth conversation with informants. The figures for crop by-products per hectare in 1967 were lower than those of 1994 because of different crop density and rotation. Although GR rice varieties produce less straw per unit of grain than traditional varieties, they are planted more densely than traditional varieties. The data indicate that the amount of straw from GR rice varieties is higher than from traditional varieties for these reasons. In addition, although in both 1967 and 1994 rice was planted twice, 1967 farmers only planted one crop of *palawija*, either soyabeans or peanuts. Conversely, in 1994, farmers planted soyabeans followed by peanuts in the dry season, thus producing more fodder.

Carrying Capacity Per Hectare of *Sawah*:

1. Before the GR era (1967):
   19,171 kg is sufficient for 1.6 head x 32.5 kg of daily feed x 365 days.
2. During the GR era (1994):
   44,527 kg is sufficient for 3.8 head x 32.5 kg of daily feed x 365 days.

Feed distribution becomes an important factor in the livestock feeding system when the carrying capacity of the land is not able to support the number of livestock. An insufficient capacity prompted the rise in cattle feed commercialisation which leads cattle raisers to have different access to feedstuffs. Meanwhile, agricultural rationalisation as one consequence of the implementation of GR has also strengthened feed commercialisation which reduces the capacity of cattle raisers particularly small, tiny and landless farmers to obtain cattle feed.

With regard to the problems of the carrying capacity of *sawah* and feedstuff commercialisation, this chapter aims to analyse four aspects of the livestock feeding system in Tirtomulyo at present. These aspects are (1) to what extent the implementation of GR has increased the productivity of *sawah* to provide every kind of cattle feed, (2) how cattle feed is distributed in the village and to what extent cattle raisers from different classes of farmers have access to the feedstuffs, (3) how the cattle raisers from different classes of farmers achieve feed sufficiency, and (4) to what extent their strategies in obtaining feed affects the sustainability of feed supplies.

5.2. Rice Straw

5.2.1. The Supply of and Demand for Rice Straw

In Asia, the ruminant populations of the rice-producing areas are dependent upon rice straw to meet part of their nutrient requirements during the cropping seasons, and in the dry season or during drought periods (Doyle, Devendra and Pearce, 1986:1). In Tirtomulyo, rice straw constitutes daily feed consumption, but it cannot entirely replace the consumption of green feed.

During the GR era, the utilisation of rice straw for cattle feed has increased. Before the GR era a very small proportion of rice straw went to the production of bricks, coconut sugar and for roofing materials. During the GR, the use of rice straw for these purposes has declined. Most roofs at present are made from tiles which are more expensive than rice straw. Villagers do not like to use the rice straw of High Yielding Varieties (HYVs) because in general it is relatively short and brittle, and therefore unsuitable for roofing. On the other hand, cattle prefer this straw so that raisers like to utilise it for feedstuffs.

The production of rice straw per hectare of *sawah* in Tirtomulyo is relatively high. According to informants' statement on rice straw production (one *bentel* per *ru*), it is estimated that wet rice straw production of IR 36 per hectare of *sawah* is 28,560 kg (714 small *bentel*), whilst IR 50, IR 52 or IR 64 is 24,990 kg (714 small *bentel*)[1]. IR 36 produces a higher quantity of rice straw than IR 50 or IR 64 because it has a bigger and taller stalk.

In Indonesia, the ratio between rice and its dry straw production was 1:2.33 (Nari, 1986:6), while in Tirtomulyo it was 1:2.50. In Tirtomulyo, the average rice production per hectare of *sawah* was 5.75 tonnes, thus the average dry rice straw production was approximately 13.39 tonnes. In this study, the amount of rice straw per plant is computed according to the fact that more than 90 per cent of the plant materials is used by the farmers as straw, the remainder left in the field as stubble.

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[1] In the local measurement system, one *ru* (14 square metres) produces one small *bentel* of wet rice straw. One hectare of *sawah* is the same as 714 *ru*, therefore it is able to produce 714 small *bentel* of wet rice straw at each rice cultivation. In the daily feeding system, one *bentel* of wet rice straw is needed to feed one head of adult cattle, thus 714 *bentel* of rice straw is enough to feed two head of adult cattle for one year.

Farmers prefer to give rice straw as dry matter, but in computing the production of straw from rice plants, they usually refer to the straw as wet matter. According to the farmers, in wet condition one small *bentel* of rice straw weighs approximately 25 kg, whilst in a dry condition it weighs 12.5 kg.

Table 5.2 shows that the total wet rice straw production of *sawah* in 1994 was 11,477,150 kg. By assuming that the wet rice straw consumption for one head of adult cattle per day is 25 kg, and for one young cattle per day is 12.5 kg[2], the capacity of *sawah* to support a certain number of cattle can be roughly estimated. This capacity was 1,258 head of adult cattle (25 kg x 365 days per one head of adult cattle).

In Tirtomulyo, the real demand for rice straw is lower than the supplies. In 1994, there were 757 adult cattle and 304 young cattle. Those adult cattle required approximately 6,907,625 kg (757 head x 25 kg x 365 days), and those young cattle required 138,700 kg (304 head x 12.5 kg x 365 days). The total demand for wet rice straw in 1994 was therefore 8,294,626 kg. Therefore, the supply of rice straw was more than sufficient to support all cattle with a surplus amount able to feed 349 head of adult cattle.

Table 5.2. Wet Rice Straw Production of *Sawah* in Tirtomulyo, 1994

Rice Planting Seasons	Rice Harvested Area (in ha.)	HYVs	Total Wet Rice Straw Production (in kg.)
1. *Gadu* Season 1993/1994	225	IR 50, IR 52 or IR 64	5,622,750
2. Wet Season 1994	240	IR 36	6,854,400
Total	465		11,477,150

Source: Primary data, 1994

[2] This rice straw includes bedding for livestock, but the quantity of rice straw for cattle feed is higher than for bedding.

Although at the village level the rice straw production is more than sufficient to feed all cattle, raisers are faced with problems in obtaining feed. First, they have only two months to collect rice straw at each harvest time i.e. the rainy season (January and February) and dry season (April and May). Second, rice straw produced in Tirtomulyo *sawah* is not only consumed in this village, but also in neighbouring villages. Cattle raisers of Tirtomulyo also collect rice straw from neighbouring villages and sometime even from North Bantul. Third, as will be discussed in a later section, rice straw has been regarded as individual property which means that farmers are not free to get rice straw beyond their *sawah* fields. The fact that rice straw is individual property means that control of rice straw is unequal among farmers and is in fact based on the different sizes of landholdings.

Table 5.3. Estimated Wet Rice Straw Production according to the Types of Producers, 1994

No.	Producers of Rice Straw	Number and Percentage of Households		Total Production of Wet Rice Straw	
		Number	Per-cent	Kg.	Per-cent
1.	Households of Non-Cattle Raisers	442	42.3	6,524,510	57.8
2.	Households of Cattle Raisers				
	a. Medium farmers	99	9.5	1,698,840	14.8
	b. Small farmers	190	18.1	1,679,600	14.6
	c. Tiny farmers	315	30.1	1,474,200	12.8
	Total	1,046	100.0	11,477,150	100.0

Note: 1. The number of cattle raisers includes the three buffalo farmers.
2. Source: Primary data, 1994.

Table 5.3 indicates that 57.8 per cent of the wet rice straw in this village was produced by non-cattle raisers (including farmers who only kept small ruminants). Tiny farmers who are the most populous of cattle raisers only

produce 12.8 per cent of total rice straw in the village. There are also 48 landless farmers who are not represented in this table because they do not produce rice straw.

5.2.2. The Impact of the Rice Harvesting System on Rice straw Distribution

In Tirtomulyo, the GR had changed the rice harvesting system which reduces work opportunities among tiny and landless farmers and has commercialised rice straw as a wage for harvest labourers. The use of rice straw as a labour payment is a new phenomenon in the rice harvesting system which is related to the rise of cattle raising and agricultural rationalisation affected by the GR.

Many of the studies noted discovered that the GR in rural Java has caused a decline of labourers in rice harvesting. Some writers who adopt a neoclassical approach like Collier, Wiradi and Soentoro (1973), and Hayami and Kikuchi (1982) suggest that the decline of labour in harvesting is a response characterised by economic rationalisation to smaller landholdings and new technology. This is seen by these writers as merely a continuation of the "economic" decision making that has always characterised their ventures. Other writers in a neopopulist tradition suggest that the reduction of labour harvesters is a dramatic change in agricultural decision making, as farmers accept the commercial basis of the new technology and are forced to ignore social obligations (Hüsken, 1982:254; White, 1989:76).

Economic rationalisation of rice harvesting has also occurred in Tirtomulyo. In the mid-1970s, farmers replaced the *bawon* system, the dominant harvesting system, with a monetary wage system (including *tebasan*), whilst in the early 1980s they replaced the monetary wage system with a rice straw compensatory system. The *bawon* system existed before the GR spread out in South Bantul. The harvest labourers received compensation for their work according to the amount of rice grain they gathered, usually one-fifth to one-seventh of total harvested rice grain.

The *bawon* system allowed many female labourers to participate in the harvesting because the wage amount was based on the productivity of workers in cutting the panicles; as long as there were rice plants in the *sawah*, all people could participate in the harvesting. Also, because it was based on the *ani-ani*, a small hand-knife for cutting the panicle, the *bawon* system absorbed many harvesters. Where farmers still maintained close communal solidarity in their village, they could not refuse labourers who asked to participate in the harvesting, even though this caused an increase in the cost of harvesting.

Almost all local rice varieties were harvested by using the *bawon* system. Technically, all local rice varieties used the *ani-ani* because on average the stalks were relatively tall, and the rice grain could be removed easily from the panicles after these had been dried. Conversely, the *ani-ani* technique was not suitable for harvesting most HYVs because the stalks are short (Hayami and Hafid, 1979:3), and the most important factor is that the grain can be threshed easily before the panicles are dried. In adopting HYVs, farmers preferred to use the *babat-gepyok* technique for harvesting paddy which enables them to reduce costs. This

technique uses a sickle for cutting (*babat*) the stalks of paddy plants. After that there is threshing (*gepyok*) of the grain from the stalks. Threshing must be done immediately after cutting the stalks because the grains are more susceptible to shattering (Hayami and Kikuchi, 1982:157). Farmers of Tirtomulyo said that the grains fall off quite easily when the stalks are moved from the *sawah* fields to home.

By using the *babat-gepyok* technique, the number of wage labourers can be reduced through reorganising the division of labour. A number of wage labourers work in cutting the plants (*babat*) and the others in threshing (*gepyok*). Farmers can select and limit those who work at the jobs of cutting and threshing. Using this division of labour, payment for the harvest is based on time allocation rather than worker productivity. The reason for this is because the productivity of workers who cut the rice plants cannot be measured from the amount of threshed grain[3].

The *babat-gepyok* technique also enables farmers to practise the *tebasan* system. *Tebasan* means farmers sell their rice production to middlemen before it is harvested. It is then the middlemen who carry out the harvesting activity. In Tirtomulyo, the *tebasan* system allows farmers to avoid the burden of harvesting cost, while it gives profit to the middlemen by reducing the number of harvesters (Collier, 1982:158; Sairin, 1976:66; Hayami and Kikuchi 1982:156). Some case studies of *tebasan* in rural Java found that where sickles (the *babat-gepyok* technique) were combined with the *tebasan* system, the reduction of harvesting

[3] In 1979, the wage harvest labour per day was approximately comparable to the cost of seven kilograms of unhusked rice per one labourer.

labour was likely to be highest (Booth, 1988:183; Collier, 1981:159; Hayami and Hafid, 1979:25; Hayami and Kikuchi, 1982:156).

In Tirtomulyo, *tebasan* also appeared in the early 1970s. This did not develop into the general pattern of rice harvesting because there were many rice straw collectors when the rice harvesting was done, and farmers utilised them to reduce the use of wage harvesters. By the end of the 1970s, almost all farmers preferred to utilise the rice straw collectors for threshing their rice. This commercial attitude toward rice straw also occurred in some villages in the Yogyakarta region in the mid-1970s. In his study of the rice harvesting system, Sairin (1976:62) found that farmers in Prambanan, Yogyakarta utilised their rice straw as a wage to the labour harvesters who kept cattle ("*derep damen*").

In general, before the GR era, people of Tirtomulyo and other villagers in South Bantul regarded rice straw as communal property. Everybody was permitted to take rice straw in *sawah* without paying for it, but since the mid-1970s, farmers who kept cattle tended to regard their rice straw as individual property. They sometimes refused the people who came to their *sawah* to take rice straw. Many people who sought rice straw then offered them payment by threshing the rice grains. Conversely, farmers who did not keep cattle then employed the rice straw collectors in order to reduce the number of wage labourers.

In the early 1980s, the competition in obtaining rice straw was relatively strong due to a rapid increase in livestock population both in Tirtomulyo and in almost all villages in South Bantul. Farmers who did not keep cattle and the middlemen who carried out *tebasan* enjoyed this competition, as they could

manipulate the division of labour in the rice harvesting. The job of cutting the rice plants was given to the wage labourers, whilst the job of threshing the grain was done by the rice straw collectors. The rice straw collectors were permitted to take the rice stalks after they had threshed the grain.

Since the early 1980s, farmers who do and do not keep cattle have different attitudes regarding livestock collectors. Farmer-cattle raisers dislike using rice straw collectors in order to have a greater amount of rice straw for their own cattle. However, the medium farmers occasionally use rice straw collectors for the harvest of their rice in January and February which is in the early part of the rainy season. They value the rice straw collectors for threshing their rice because they can finish harvesting quickly before the rains come and so prepare for the next rice cultivation. It is only at the harvest of rice during April and May that they usually do not use rice straw collectors. It is still the rainy season and almost all paddy fields in South Bantul are being harvested and replanted during these months so there is no spare time for many rice straw collectors to participate in the rice harvesting.

Farmers who do not raise cattle, on the other hand, prefer to employ rice straw collectors as much as possible. They sometimes call their neighbours, friends and other people who keep cattle to participate in threshing their rice. As an illustration, a man who harvested 0.2 hectare of rice in January 1995 only used five wage labourers for one day, although normally without using rice straw collectors 20 hired labourers for one day must be used. Fifty-five rice straw collectors came to the rice harvesting. By using rice straw collectors, the farmer only spent Rp. 15,000 for the five hired labourers. Without using rice straw

collectors, he would spend approximately Rp. 60,000 to pay 20 hired labourers. However, if he used hired labourers only, and then sold the rice straw, his potential income could be at least Rp. 112,800. However, cattle raisers are willing to work for rice straw, but not to buy it for cash.

Besides reducing the cost for the farmers, the rice harvesting system gives an advantage to rice straw collectors over wage labourers. The compensation for threshing rice grain in terms of rice straw is lower than the wage of rice harvesting. However, the rice straw collectors argue that gathering rice straw by threshing the rice grain is the best way to fulfil the demand for cattle feed. A wage labourer who works cutting the rice stalks is paid Rp. 3,500 a day and receives lunch, equivalent to Rp. 500, for approximately five hours of work. A rice straw collector usually works to get one big *bentel* (approximately 60 kg) of rice stalks taking approximately two hours. The price of one big *bentel* of wet rice straw varies between Rp. 1,000 to Rp. 1,200[4].

5.2.3. Rice Straw Sufficiency

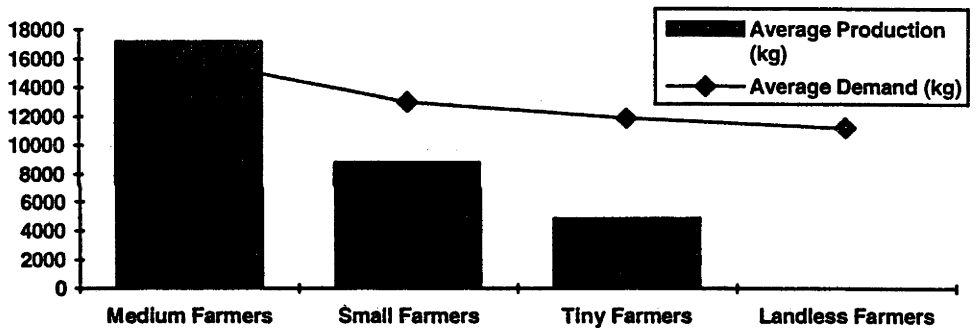
The consequence of the rice straw commercialisation now occurring with the new rice harvesting system leads farmers-cattle raisers to keep their own rice straw in order to achieve feedstuff self-sufficiency. When their own rice straw is not sufficient to fulfil the demand, they collect rice straw by participating in the rice harvesting. They can also buy rice straw, but this is a secondary choice after gathering rice straw. Gathering is usually carried out once a day producing about one big *bentel* of wet rice straw (approximately 60 kg) which can be used to feed

[4] Those who buy wet rice straw are generally cattle traders, while cattle raisers like to buy dry rice straw for their feed storage.

a single adult head of cattle for two and half days. The rice straw collectors usually use a bike to take the straw from the fields to their homes.

The degree of rice straw self-sufficiency among farmers depends upon the size of their landholding, the number of cattle and their ages. On average, the size of herd among medium farmers was 2.0 head of cattle, the small farmers 1.7 head of cattle, the tiny and landless farmers 1.5 head of cattle. Chart 5.1 shows that on average, medium farmers achieved rice straw self-sufficiency.

Chart 5.1. Average Annual Production and Demand for Wet Rice Straw among Individual Farmers, 1994



Note: 1. The average production of wet rice straw among farmers is determined by the size of their landholding. Medium farmers held 0.33 hectare, small farmers 0.17 hectare, and tiny farmers 0.09 hectare, while landless farmers have no land.
2. The average demand for rice straw is determined by the size of herd. The average herd of medium farmers was 2 head of cattle, small farmers 1.7 head of cattle and the tiny and landless farmers 1.5 head of cattle.
3. Source: Primary data, 1994.

On the basis that rice straw is individual property, and is not given to anyone free of charge, medium farmers were able to sustain cattle feed sufficiency without working in the rice harvesting. In theory, they even had 1,214 kg of wet rice straw surplus, a calculation based on average *sawah* area and number of cattle. Their rice straw production was 17,166 kg, while their demand was 15,940 kg.

On average, small and tiny farmers, whose herd size was smaller than that of medium farmers have not yet achieved rice straw self-sufficiency. Nevertheless, by participating in the rice harvesting most of them then achieved rice straw sufficiency. Most landless farmers who depended absolutely on participating in the rice harvesting also achieved rice straw sufficiency, although they had to work hard.

The frequency with which rice straw is collected by working as rice harvesters is influenced by the amount of their own rice straw production and the size of their herd. In 1994, based on average landholdings and cattle numbers, small farmers had 8,840 kg of rice straw while their demand was 13,015 kg. In theory then each had to work at least 70 days[5] participating in others' rice harvesting, on the assumption that at each rice harvesting he got approximately 60 kg of wet rice straw. On average, tiny farmers had 4,883 kg, while their demand was 11,187 kg of rice straw. Each required 6,994 kg of additional wet rice straw which could be obtained by participating for 117 days in others' rice harvesting. Landless farmers worked harder than others. Each required 11,216 kg of wet rice straw which was obtained by working 186 days in rice harvesting.

The fact that, on average, medium farmers achieved rice straw self-sufficiency does not mean that they did not participate in the rice harvesting. In 1994, for example, 68 of the 99 medium farmers participated in rice harvesting. They realised that the supply of wild grass in the village was not sufficient to feed cattle, and preferred to give more rice straw to their cattle. Most smaller farmers also required rice straw gained from harvesting other farms to reduce their

[5] Farmers can carry out gathering rice straw twice a day if it is conducted within the villages, but only once if gathering is conducted beyond the village.

demand for other green feed. Another reason for participating in the rice harvesting is that the medium farmers liked to keep some in storage to overcome an increase in demand for rice straw by new cattle in the next year.

Even though medium farmers participated in rice harvesting, they did not attend beyond the village. Conversely, other farmers, particularly tiny and landless farmers, worked on *sawah* outside the village. This occurred because the harvesting system allowed people from everywhere to thresh rice grains. As a result, rice straw in Tirtomulyo was seized by people from many villages. Tiny and landless farmers who depend heavily on rice harvesting to feed their cattle could not expect to fulfil their demands by working in the village alone. They were forced to collect rice straw outside the village. In 1994, most of them collected rice straw in neighbouring villages, and many of them collected in the villages of North Bantul, which are situated around 7 to 10 km from Tirtomulyo. This means that tiny and landless farmers spend a longer time collecting rice straw than medium and small farmers. When they collected rice straw outside the village, they spent around one to three hours travelling and one to three hours participating in the rice harvesting.

When gathering rice straw does not cover the demand for feed, farmer-cattle raisers consider buying rice straw. In 1994, there were 61 cattle raisers who bought rice straw, and on average each of them spent Rp. 34,154 for buying this feed. All of them were farmers who keep more than one head of cattle. The highest percentage of those who bought rice straw were landless farmers (27 per cent, medium farmer (16 per cent), small farmers (9.5 per cent), and tiny farmers (5.1 per cent). All of them bought rice straw because they were busy with

agricultural activities, and consequently did not have enough time for gathering rice straw. In addition, they bought rice straw to reduce grass consumption.

The cattle raisers usually buy rice straw from South Bantul, and occasionally purchase it from North Bantul, and even from the Purworejo Regency of Central Java. The traders are those farmers who have surpluses of rice straw, and those who occasionally utilise their own rice straw for cash income. They sell rice straw to the truck and animal cart drivers who are instructed to buy rice straw for the cattle raisers. In 1994, one truck of dry rice straw was valued at roughly Rp. 50,000. - Rp. 100,000. The price of rice straw was influenced by many factors, such as the harvesting season, the distance between Tirtomulyo and the villages where the truck and cart drivers obtained this feed, and the relation between the truck drivers and the consumers.

5.3 Rice Bran

Rice bran (*bekatul/dedak/katul*) is another by-product of rice which is used both for poultry and livestock feed. In Indonesia and other rice growing countries, the GR led to an increase in rice bran production which promoted both poultry and livestock raising. However, in Indonesia, the highest proportion of rice bran production is used for swine and poultry feed (Manurung, 1990:285; Simpson, 1990:27). Rice bran used for livestock is primarily consumed by dairy cows (*sapi perah*) rather than beef cattle (*sapi kereman*).

In Tirtomulyo, the GR has changed the use of rice bran among the villagers. Before 1974, most farmers utilised a small proportion of their rice bran to feed their own chickens and a high proportion of this was to generate a cash income. The price of rice bran during the early GR was very cheap in comparison

to the price of rice. For example, in 1972, one kg of rice bran was Rp. 2.5, and the price of rice was Rp. 40, while in 1994 the price of rice bran was Rp. 250 per kg during the harvest season, and the price of rice was Rp. 850 per kg. However, because of the relative abundance of grass for feed during the early GR era, farmers who were poor preferred to sell their rice bran rather than use it for their chicken or cattle.

To carry out a further analysis, it is relevant to examine the importance of rice bran for overcoming the insufficiency of grass. As will be analysed in the next sections, the supply of *palawija* by-products in the village was only able to meet 35 per cent of the total green feed demand, while wild grass only met 19 per cent of demand.

Farmers who carry out cattle breeding (84 per cent of cattle raisers) usually use their rice bran for their animals, although they occasionally use some to pay for rice milling[6]. They calculate that when rice bran is used to reduce the demand for grass or green feed, one grass basket (*liri*) of green grass (approximately 20 kg) is comparable with five kg of rice bran. In the daily feed system, they usually give about two kg of rice bran to one head of adult cattle, or one kg of rice bran per head for younger animals, whilst the amount of green feed for adult cattle is 12 kg, and 6 kg for younger cattle. In other words, one kg of rice bran is comparable with four kg of green feed. The function of green feed

[6] The proportion of rice bran which is used for paying rice milling costs is less than that used for cattle and chicken feed. For example, on average 100 parts of unhusked rice (*gabah*) is composed of 68 per cent milled rice (*beras*), 20 per cent of rice hulls (*merang*), and 12 per cent of rice bran (Nari, 1985:12). The cost of rice milling per kg of rice grain is Rp. 20; whereas the price of rice bran per kilogram in 1994 was Rp. 250. Thus, the total cost of 100 kg of rice milling is Rp. 1,360 which is comparable with 5.4 kg of rice bran. A farmer who mills 100 kg of *gabah*, gets 12 kg of rice bran; and he can use 5.4 kg of this bran for paying the cost of milling and 6.6 kg for cattle and chicken feed. The proportion for chicken feed is usually 10 per cent, while cattle feed constitutes the remaining 90 per cent.

cannot totally be replaced by rice bran. Farmers argue that grass is the most important feed for cattle growing and reproduction, whereas rice bran is but one kind of feed for fattening.

Farmers expect to consume rice bran everyday because the supplies of green feed are not sufficient to meet the demand. However, they usually never buy additional rice bran even if their own production is not enough to cover this demand. Only landless farmers often buy rice bran. In 1994, of 41 landless farmers who carried out cattle breeding, 20 bought rice bran, and on average they bought 80 kg per year.

Table 5.4. Theoretical Reduction of Green Feed Demand By Using Rice Bran among Farmers Who Carried Out Cattle Breeding, 1994

No.	Farmers	Number of Cattle		Demand for Green Feed (kg)	Rice Bran Pro-duction (kg)	% Green Feed Re-duction
		Adult	Young			
1.	Medium farmers (N=82)	129	50	1,124,200	31,590	11.2
2.	Small farmers (N=165)	207	84	1,817,700	33,971	7.5
3.	Tiny farmers (N=259)	286	115	2,507,550	26,096	4.2
4.	Landless Farmers (N=41)	42	18	372,300	1,600	1.7
	Total (N=547)	664	287	5,821,750	93,257	6.4

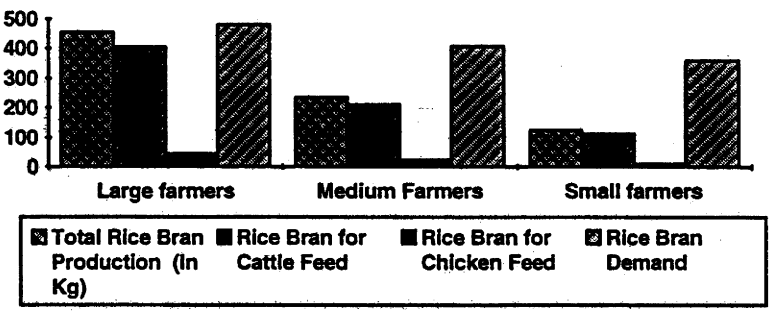
Note: 1. The cattle raisers including three farmers who keep eight head of buffaloes.
2. Source: primary data, 1994.

Table 5.4 computes the rice bran production among the farmers who carry out cattle breeding. It includes 20 landless farmers who bought rice bran in

1994. Overall, their rice bran production reduces by 6.4 per cent the green feed consumption[7].

The most important time to reduce green feed consumption is during the first stages of rice growing. When the rice plants are younger than 60 days, there is almost no available wild grass in the *sawah* land. During each year, the lack of grass feed in *sawah* land occurs for approximately 120 days because the rice crops are planted twice, and the main planting seasons run from the mid-January until mid-March, and from October to November. However, during November cattle raisers do not necessarily use rice bran because occasional rain fall allows grass to grow quickly in the *sawah* bunds and along the edges of road.

Chart 5.2. Estimated Pattern of Rice Bran Usage among Farmers in 1994



Notes: 1. The demand for rice bran production was based on the herd size (See Notes for Chart No. 5.1).
2. Source: Primary data, 1994.

Chart 5.2, illustrates the average rice bran production among farmers who keep cattle for breeding. If keeping two head of cattle, medium farmers were almost able to solve the problem of the lack of wild grass during the first phase of rice growing. They had 405 kg of rice bran per year, while their demand

[7] This reduction by rice bran is relatively low. As mentioned in the Chapter 4, the farmers argue that they have no capital to buy rice bran, and that using more rice bran would not gain much advantage because their cattle are not for producing meat, but offspring.

was 480 kg. The small and tiny farmers were unable to cover the demand for reducing their grass consumption by using their own rice bran production alone.

The second function of rice bran is to promote cattle fattening. An increase in rice bran consumption for cattle fattening has occurred since the mid-1970s when some farmers were successful in fattening underweight cattle. They used their own rice bran and many of them bought rice bran to feed their cattle everyday.

Table. 5.5. Theoretical Reduction of Green Feed Demand By Using Rice Bran among Farmers Who Carried out Cattle Fattening, 1994

No.	Farmers	Number of Cattle		Demand for Green Feed (kg)	Rice Bran Production (kg)	% Green Feed Reduction
		Adult	Young			
1.	Medium farmers (N=17)	17	4	138,700	16,424	47.4
2.	Small farmers (N=25)	23	10	240,900	16,950	28.1
3.	Tiny farmers (N=56)	47	19	412,450	23,627	22.9
4.	Landless Farmers (N=7)	6	4	58,400	2,679	18.3
	Total (N=105)	93	37	850,450	59,680	28,1

Source: Primary data, 1994.

Nowadays, 16 per cent of the total cattle raisers carry out cattle fattening. In 1994, on average, each of them bought 267 kg of rice bran. Table 5.5 indicates that the average reduction of green feed consumption amongst the farmers was 29.3 per cent. The reduction of green feed used by medium farmers was very high.

In summary, overall, the use of rice bran both for cattle fattening and breeding systems achieves approximately 17.4 per cent reduction in green feed consumption. Medium farmers who have greater economic assets than others are

almost able to solve the problem of limited wild grass during the rice growing seasons.

5.4. *Palawija* By-Products

5.4.1. The Supply of *Palawija* By-products

Palawija (secondary crop) is the common term in Java used to categorise all non-paddy crops grown on *sawah*, or dry land (*tegalan*) except sugarcane[8]. In Tirtomulyo, the *palawija* crops which produce by-products for cattle feed are soyabean, peanut, maize, and sweet potato. The by-products consists of the straw of these plants, while with soyabean it is mainly the shell of soyabean[9].

Table 5.6 shows that Tirtomulyo *sawah* in 1994 produced approximately 2,258,875 kg of *palawija* by-products. These by-products theoretically supported 309 adult cattle a year (365 days x 20 kg of daily green fodder for one head of adult cattle). The availability of *palawija* by-products permits cattle raisers to reduce their time allocation for collecting wild grass, and to solve the problems of insufficient grass supply in the village. Overall, the *palawija* by-products in this village theoretically contribute 34 per cent of cattle green feed demand.

The important role of *palawija* by-products for reducing the consumption of wild grass feed appears in the early dry season when grass supplies are very

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[8] Sugarcane is now planted in Tirtomulyo using 19 hectares of *sawah* land belonging to the village government. In this discussion, although the plant produces a top (*pucuk*), it will not be taken into account in the analysis of the feeding system. This is because during 1994, the plants were still growing. Furthermore, before 1994, most farmers would not gather top for their animal feed, as an expression of their hate of the sugarcane plantations.

[9] Most farmers do not use the leaves of soyabeans because when harvesting these plants, they usually cut the stalks and then leaves them in the fields for one or two days. After that, the leaves become wilted and dried, and then farmers thresh the soyabean grains out from their husks (*titen*). According to the farmers, most wilted and dried soyabean leaves cannot be used for cattle feed so they are left in the fields.

limited in the village. Farmers reported that during August and September, there were insufficient grass supplies in the peanut fields, but they had by-products of soyabeans (*titen*) or maize (*tebon*).

Table 5.6. Production of *Palawija* By-Products in Tirtomulyo, 1994

No.	Kinds of *Palawija* Crops	Crop Harvested Areas (in ha.)	Name of By-Products	Production of *Palawija* By-product	
				Per Hectare (in kg)	Total (in kg)
1.	Soyabean	200	*Titen*	4,450	890,000
2.	Peanut	125	*Rendeng*	8,927	1,115,875
3.	Sweet Potato	9	*Elung*	7,000	63,000
4.	Maize	10	*Tebon*	20,000	200,000
	Total	-	-	-	2,258,875

Source: Primary data, 1994. These figures were calculated from informants' statements of general harvest per 500 m^2.

Although *palawija* by-products support approximately 309 head of cattle in the village, the cattle raisers only produce 57.3 per cent, and the remainder is produced by farmers who do not keep cattle. However, many non-cattle raisers who have much land prefer to plant chillies and onions which do not produce by-products for cattle feed. Conversely, the cattle raisers prefer to plant soyabeans and peanuts.

Table 5.7 notes the total amount of *palawija* by-products among the farmer-cattle raisers, and the proportion by which their by-products reduce the consumption of green feed. It is shown that medium farmers achieved a reduction of 34.6 per cent in demand for green feed, while landless farmers had no capacity to reduce their demand for green feed.

In 1994, on average, the medium farmers produced 4,415 kg of *palawija* by-products (vines and *titen* only), small farmers 2,274 kg, and tiny farmers 1,204 kg. The medium farmers, therefore, were in a better position to overcome

the limited supply of wild grass than the small and tiny farmers. With on average two head of cattle, the medium farmers in theory utilised their own by-products to replace grass feed for 110 days. The small farmers in theory with an average of 1.7 head of cattle were able to replace grass feed for 67 days, whilst the tiny farmers with on average of 1.5 head of cattle were able to replace grass feed for 40 days.

Table 5.7. Demand for Green Feed and Production of *Palawija* By-Products among Farmer-Cattle Raisers, 1994.

No.	Farmers	Number of Cattle		Demand for Green Feed (Kg)	Amount of By-products (Kg)	% Green Feed Reduction
		Adult	Young			
1.	Medium farmers (N=99)	146	54	1,262,900	437,085	34.6
2.	Small farmers (N=190)	220	94	1,949,100	432,060	22.2
3.	Tiny farmers (N=315)	343	134	2,993,100	379,260	12.7
4.	Landless Farmers (N=48)	48	22	430,700	-	-
	Total (N=652)	757	304	6,635,700	1,248,405	18.3

Note: 1. Including three buffalo raisers with eight of their animals.
2. By-products of *palawija* in this table are only vines and soyabean 'straw'.
3. Source: Primary data, 1994.

5.4.2. The Impact of Harvesting System on *Palawija* By-product Distribution

In Tirtomulyo, by-products of *palawija* are more valuable than rice straw. Before rice straw changed its status from common property to individual property, farmers regarded maize straw (*tebon)* and vines (*rendeng*) as individual

property. At that time, some farmers had commercialised their *rendeng* and *tebon* by selling them to traders and horse cart drivers.

Traditionally, soyabean, peanut and sweet potato crops were harvested by using reciprocal labour (*sambatan*). A farmer who harvested his *palawija* crops usually asked his neighbours for help, and consequently he had to help them when they harvested their crops. Workers received a meal during their work. They did not have any opportunity to take the by-products of soyabeans and peanuts. It was only with those farmers who did not have cattle that labourers could request these feedstuffs. However, farmers who harvested the *palawija* crops could refuse their requests.

The *tebasan* system existed for *palawija* crops before the implementation of the GR, but then became more common in the early 1970s. The aim of selling the crops to the middlemen (*penebas*) prior to the 1970s was to get a cash income directly to meet the urgent demand for cash. In the early 1970s it met similar purposes and also avoided the use of reciprocal labour which cost more than wage labour[10]. Since the late 1970s, many cattle raisers have begun to participate in the *palawija* harvesting without asking for a wage except the crop by-products. This allowed those who did not keep cattle to greatly reduce labour costs.

Nowadays, all farmers who do not keep cattle use cattle raisers' labour for harvesting their crops. However, in maize harvesting, farmers prefer to use hired labourers because they regard *tebon* as a marketable product and harvesting maize is easier than harvesting other crops. Another reason is that the harvesting cost of maize is much lower than the price of its straw. In Bantul, the

[10] In the last two years, there were almost no *penebas* who bought *palawija* crops (peanuts and soyabeans) due to a decline in production because of virus.

harvesting cost of maize per one hectare was Rp. 23,223 in 1993 (Biro Pusat Statistik DIY, 1994b:29), while in the village the price of *tebon* per hectare was approximately Rp. 240,000.

Farmers who breed cattle have different attitudes to their *palawija* by-products. When harvesting peanuts, maize or soyabean, they prefer to use their own household members in order to keep their by-products for their animals. This means that the distribution of these feedstuffs among the villagers only occurs with the farmers who have no cattle. The soyabean and peanut harvesting system thus reduces the work opportunities for landless and tiny farmers who do not keep cattle.

Although the payment for the harvesting is not money but vines or *titen*, or *elung* the cattle raisers argue that the by-products have a higher value than if they were paid as labourers. By working for two days, a cattle raiser receives at least four baskets of vines, *titen*, or *elung* which is valued at Rp. 6,000, whilst a harvest labourer would receive Rp. 5,000.

The secondary crop harvesting system allows cattle raisers to obtain the by-products without competing with outsiders. Depending on the size of farms, non-cattle raisers usually ask one to three cattle raisers in their hamlet to participate in their soyabean or peanut harvesting. They prefer to use the cattle raisers who live in the same hamlet with them as an expression of social solidarity and to arrange the harvesting more economically. Harvesting continues over a full day or even more than one day. The first day is used for cutting the soyabean plants, and the second day is used to thresh the soyabeans (*gedig*). In the case of peanuts, the first day is used for pulling the plants out from the soil, and the second day is used for separating the peanut beans from the plants. In this

harvesting system the owners have an 'obligation' to serve lunch or dinner to the harvesters. Because of this, the harvesting cost would be high if the number of workers was not limited.

All farmer-cattle raisers expect to have additional *palawija* by-products through participation in the harvest of these crops in their hamlets. However, the small, tiny and landless farmers usually have a better opportunity to participate in the harvest of these crops. The medium farmers have the opportunity to join in the harvesting because of their kinship relationship with other crop owners. The clash of harvesting times means the medium farmers are too busy with their own crop harvesting while the small and tiny farmers with less land have spare time which can be utilised for collecting the by-products from their neighbour's crops.

By participating in the harvests of secondary crops, cattle raisers have additional green feed, but generally the amount of this green feed is relatively small. Moreover, in the hamlets where the number of cattle raisers is high, many of them have no opportunity to obtain additional *palawija* by-products. It is only in the hamlets where the number of farmers who keep cattle and do not keep cattle is relatively equal that most cattle raisers have additional *palawija* by-products. In the Genting hamlet, for example, all farmers who were non-cattle raisers planted soyabeans, and half of them also planted peanuts. In 1994, the total area of their soyabean crops was approximately 8 hectares, while that of the peanut crop was 4.5 hectares. The cattle raisers consisted of 10 medium farmers, 18 small farmers, 20 tiny farmers and 3 landless farmers. All small, tiny and landless farmers of cattle raisers participated in the harvesting, and in general they obtained 1,700 kg of by-products. These medium farmers participated in the harvesting, and in general they obtained 600 kg of by-products.

Even though small, tiny farmers and landless farmers participated in the harvests of *palawija*, they still lacked green feed, and the quantity of *palawija* by-products which they had both from their own production and participation in the harvesting was lower than that of medium farmers. In Genting, for example, a small farmer was able to obtain *palawija* by-products for approximately 80 feed days, and a tiny and landless farmer for 60 feed days, while a medium farmer participating in the other harvests of *palawija* crop had approximately 125 feed days.

5.5. Grasses

5.5.1. Habitat and Production of Grass

In analysing the capacities of grass to fulfil the demand for livestock feed, this section takes account of the demand by cattle and small ruminants. In Tirtomulyo, grass feed consists of cultivated grass (*kalanjana*), and wild grass (*suket alam/suket thukulan*). Farmers realise that as cattle feed, *kalanjana* is better quality than wild grass. Furthermore, by planting *kalanjana* they can reduce the amount of labour and time required to gather wild grass, and solve the problem of the lack of wild grass supply in the village. Farmers began to plant *kalanjana* 15 years ago. This grass plant was introduced by the government to improve and increase livestock feed. However, the number of farmers who cultivated this plant was small (26.3 per cent). Most farmers do not cultivate this plant because they have no available arable lands. They are also worried about planting this grass on the bunds of their *sawah* because all bunds are used as communal paths for access to the *sawah* areas.

The village government, indeed, dislikes the planting of *kalanjana* on the *sawah* bunds because this might cause conflicts to arise between the farmers who own the *sawah* land contiguous with the bunds. They claim that all *sawah* bunds are common property with their primary function as access paths into the *sawah* fields. In addition, many *sawah* bunds constitute the boundary of land ownership, and individual *sawah* plot owners cannot claim exclusive rights to utilise them. Although the village government disapproves of *kalanjana* on *sawah* bunds, farmers have no alternative land and are thus obliged to use the bunds which they claim in their own right. They cultivate the grass on those bunds which they consider would not block the access of people who traverse these areas.

In 1994, on average the size of *kalanjana* land per individual farmer was 26 m^2, whilst the total *kalanjana* areas in this village was 0.50 hectare. There is little difference in *kalanjana* land among the farmers. Most farmers have about 20 m^2 of *kalanjana* area. In 1994, the total production of *kalanjana* was approximately 50,000 kg of green fodder with the capacity to feed seven head of cattle. The proportion of *kalanjana* production to the total demand for green feed was 0.7 per cent.

In general, livestock raisers depend more upon natural or wild grasses. There are various kinds of wild grass, but farmers know six kinds of the wild grass which can be used as livestock feed. These wild grasses are *klitik, kremah, tuton, grinting, teki, lamuran.* Farmers regard wild grass as the hair of the earth (*wulu bumi*), which means that the grass always grows like human hair even though cut frequently. In the village, the habitats of the wild grass are *sawah* fields, *sawah* bunds, road edges, slopes of water channels, and open space (*lapangan*).

The areas of grass habitat have decreased over the last 25 years, due to an increase in crop intensification and extension, and the encroachment of human settlement. The GR has obviated the need for a fallow period during the dry season. It has also caused farmers to maximise the use of arable land by reducing the size of *sawah* bunds to extend the areas of crop cultivation. Before the GR, the width of *sawah* bunds was approximately 35 cm, but during the GR farmers reduced it to 30 cm. Before the GR era, one hectare of *sawah* had approximately 400 m^2 of bunds, which has been reduced to 360 m^2 at present. Also, prior to the GR, the total area of *sawah* bunds was approximately 9.6 hectares, whilst at present it is 8.6 hectares. The production of grass feed from one hectare of *sawah* bunds is 300 baskets (or 7,500 kg) a year.

Road edges provide important grass resources for the cattle raisers in rice growing areas (Doyle, Devandra and Pearce, 1986:17). In Tirtomulyo, there are three kinds of road which produce considerable grass feed. The first type consists of the roads along irrigated water channels. The length of these roads is approximately six km, and the width is 1.5 meters[11]. The wild grass area on these roads is 0.6 hectare which produces 8,640 kg of grass feed a year. The second kind of road comprises the main roads crossing the village settlements. The length of these roads is three kilometres. In 1992, these were asphalted which caused a reduction in the area of grass. The grass area of these roads at present is 0.45 hectare which can produce 6,480 kg of grass feed a year. The third type encompasses non-asphalted roads. The length of these roads is six kilometres and the width is 1.5 metres. The grass area on the roads is 0.3 hectare which produces 4,320 kg of grass feed a year.

[11] This estimation is based on an informant's statement that he can collect one basket (*keranjang liri*) of grass from 100 metres of road 1.5 metres wide.

The decline of wild grass areas has been accompanied by increasing weed-grass production in the rice and *palawija* fields, as an indirect impact of the use of chemical and manure fertilisers for those plants. Before farmers used chemical fertilisers, they almost never took the weeds for cattle feed. Since the use of chemical fertilisers, the weeds grow more and more luxuriantly. When rice is growing, farmers remove the weeds twice: when the plants are at 35 days, and at 70 days. At the second clearing, they take the weeds for cattle feed. Farmers also have an opportunity to take the weeds from the rice fields when the plants have been harvested. Before the weeds are given to cattle, farmers clean them with water, and then dry them out in the sun. It is estimated that one hectare of rice fields produces 1,571 kg of weed grass per year.

The growth of weed grass on the *palawija* land (including soyabeans, peanuts, and vegetables) is faster than on the rice land. Farmers pull out or cut the weeds in *palawija* fields three times, twice when they weed the crops and when the last harvest of crops has finished. It is estimated that one hectare of soyabean and peanut fields produces 2,571 kg of green feed a year having been harvested three times.

In the onion and chilli fields, weeds also grow rapidly. However farmers usually take the weeds after the chilli plants are harvested. During the onion and chilli growing seasons, the young weeds are cut frequently, so they cannot be used for feed. After they are harvested, farmers then fallow the fields for one and half months, and then the fields are used for paddy in the wet season. The production of grass per hectare of the land during the fallow period (45 days) is approximately 1,050 kg - which can be harvested twice.

Table 5.8. Estimated Wild Grass Production in Tirtomulyo, 1994

No.	Habitat of Wild Grasses	Areas of Wild Grass (n Hectare)	Production Per Hectare (in Kg)	Total Production (in Kg)
1.	Rice Fields	465.0	1,571	730,515
2.	*Palawija* Fields	225.0	2,571	578,475
3.	Fallow land of Onion and Chilli Crops	12.0	1,050	12,600
4.	Bunds of *Sawah*	8.6	7,500	64,800
5.	Edges of Road	1.4	14,400	19,440
6.	Open Space	1.0	21,000	21,000
7.	Slopes of Channels	4.0	7,500	30,000
	Total	-	-	1,456,830

Source: Primary data, 1994.

Table 5.8 shows that the total production of wild grass was 1,456,830 kg. This production was not sufficient to cover the total amount of green feed consumption in 1994, based on the livestock feeding system, in which ideally one cow consumes approximately 20 kg of green fodder per day, and one calf consumes 10 kg, while three small ruminants consume 20 kg. The total demand for green feed was approximately 7,385,167 kg which consisted of 6,825,500 kg for cattle feed (including eight head of buffalo), and 559,667 kg for small ruminant feed. The amount of wild grass production in the village, in fact, was only able to cover 19.7 per cent of the total greed feed demand. In simple terms, it can be underlined that farmer-cattle raisers lack green feed. The land of Tirtomulyo is only able to produce approximately 54.4 per cent of green feed demand consisting of 19.7 per cent of wild grass, 34 per cent of secondary crop by-products, and 0.7 per cent of *kalanjana* plants. By using rice bran, farmers met 17.4 per cent of total green feed demand.

Wild grass has become a scarce resource because of the increasing cattle population in the village. Nevertheless, this has not changed the wild grass in *sawah* from common property to individual property. Hayami and Kikuchi

(1982: 126) argue that the more scarce a resource, the property rights to the resource becomes more exclusive and clearly defined. Their arguments, indeed, are applicable to rice straw but not to wild grass.

Tirtomulyo farmers regard all vegetation which exists naturally as common property. Grass which grows on the road edges is regarded as common property, and thus everyone has the right to exploit it. This attitude, as Hardin postulated, allows over-exploitation to occur, and thus reduces the productivity of resources (Acheson, 1986:357).

Farmers' private interests take priority over public interests in manipulating the concept of common property (Popkin, 1984:13). Every grass cutter is permitted to take the weeds because these threaten the crops. During the weeding period of the paddy, the crop owners, who have no cattle, like to ask the tiny or landless farmer-cattle raisers to carry out this work. These cattle raisers are expected to work seriously to pull out the weeds from the fields. They receive wages and also take the weeds. Farmers who do not have cattle also encourage grass cutters to collect weeds in their *sawah* after the crops are harvested in order to reduce the clearing costs. Indeed, a few medium farmers lure grass cutters to come to their *sawah* fields by fertilising the soil.

> Ijan, Sutopo and Mukayat discussed the grass-supply problem in the village. All of them argued that lack of grass gives an advantage to the farmers. Both Mukayat and Sutopo have utilised the grass cutters to save on the expense of weeding their fields after the harvest. They pour fertilisers on the soil. The grass grows rapidly, and then some grass cutters will come to the land 15 days after the soil has been fertilised. Mukayat explained that the size of his land is approximately 0.25 hectare. He spent Rp. 12,000 buying urea fertilisers. If he hired labourers for clearing the fields he would spend at least Rp. 32,000 and be obliged to oversee their work.

That medium farmers fertilise the grass in their *sawah* fields is a new phenomenon in the last four years. It might become a common feature in the future, which would be one means of solving the limited supply of wild grass. Nevertheless, the problem of the lack of wild grass in the village is at present a critical problem which determines the sustainability of cattle raising in the future.

5.5.2. Grassing Strategies

Collecting grass constitutes an important aspect of livestock raising in the village. The original livestock feed was wild grass, but wild grass is one source of green feed which is becoming a scarce resource - in the sense that the demand for this resource has increased rapidly due to the rise of the animal population. Second, wild grass is common property to which everyone has access - as long as they can devote the time to collect it. Third, ideally grass must be collected everyday to ensure fresh grass for their animals. Therefore, there is intense competition in obtaining this livestock feed.

The fact that green feed supplies in the village are insufficient to fulfil the demand leads farmers to seek other solutions. A small number of farmers who are categorised as medium and small farmers have solved this problem by using rice straw to reduce the consumption of wild grass. All farmers have reduced the consumption of green feed by using rice bran. However, the majority of cattle raisers still lack green feed.

The common way to cover the demand for green feed is to collect wild grass both inside and outside the village. Cattle raisers tend to resort to feed gathering strategies which are overall both counter-productive and environmentally destructive. This strategy is common to all farmers, but it is the

tiny and landless farmers who require the most wild grass to fulfil demand compared with the medium and small farmers.

Grass over-exploitation in fact occurred in the 1960s before the GR[12]. At that time, the supply of green feed, both wild grass and *palawija* by-products, was lower than at present. However, because the number of cattle was relatively low, grass exploitation was not strong.

In the 1960s, insufficiency of wild grass not only occurred in Tirtomulyo, but also in most villages of South Bantul. At that time, farmers then used a very counter-productive feed-gathering strategy. By using a sickle with double-edged blades, grass cutters were able to "pull" and "push" the grasses. A standard, single-edged sickle can only be used to cut in one direction, that is, at the "pull" which only cuts the leaves of the grass, but by employing a double-edged sickle the grass-cutter also cuts on the forward stroke, or "push" stroke. Whilst this action permits the grass-cutter to obtain shorter and younger grasses, at the same time, this damages the roots and disturbs the soil.

At present, farmers in Tirtomulyo also use this double-edged sickle so that they can easily cut young and short grasses on the edges of roads. The grass cutters compete fiercely with each other for grasses in these places and cut young grass to its roots. They visit the same places frequently, mainly when there is not enough wild grass in the *sawah*. As a result, their over-cutting degrades soil reducing the growth and availability of grasses in the future.

Fertilisers have promoted the growth of weed-grass in *sawah* thus obscuring the evidence of these counter-productive grass-cutting practices. The

[12] In the 1960s, the insufficient supply of wild grass forced many people from Tirtomulyo to seek grass outside the village, mainly in the mountainous areas of Parangtritis located six kilometres to the east. Many people from the villages of Kretek sub-district also came to this area which is now used for horticultural crops.

rapid growth of grasses in the *sawah* presents problems for rice and secondary crop planting, so farmers consider these grasses to be weeds and encourage grass-cutting practices in order to increase crop production.

Cutting young grass exacerbates soil degradation and does not solve the problem of insufficient green feed because farmers not only cut young grass suitable for feed, but also many grasses which cattle do not like. They explain that many grasses, whether in the *sawah* or along the edges of the road, are tainted by polluted water from the Southern settlements of the Bantul Regency. The polluted grass acquires a putrid taste, and in order to induce the cattle to eat them, some farmers give medicinal herbs (*jamu*) to the cattle. These medicinal herbs induce hunger and also include chicken egg which has a putrid taste like the taste of the polluted grass. Thus, cattle can be induced to eat the polluted grass because the taste is masked by the taste of egg.

Intensive grazing seems to be higher in Tirtomulyo than in neighbouring villages because there are almost no grass cutters from neighbouring villages who come to Tirtomulyo. Conversely, most grass cutters from Tirtomulyo gather grass in the neighbouring villages. This is because the cattle density in Tirtomulyo was relatively higher than in all neighbouring villages[13].

Grass cutting by cattle raisers in Tirtomulyo has not achieved grass feed sufficiency. Many of them were only able to provide for the minimum feed requirement. A veterinary assistant noticed the phenomena of insufficient feed consumption among cattle in South Bantul, including Tirtomulyo. He found that mature female cows were almost never able to bleat (*njombor*) and to announce

[13]Cattle density in the South Bantul was approximately four head per one hectare of *sawah* in 1994 (Biro Pusat Statistik DIY, 1994a:123).

their readiness when they were fecund and their vaginas did not have mucus and become *abuh* which means that the vaginas become swollen and red. This occurred because the animals lacked green feed which contains vitamins for fecundity. Many farmers, therefore, were not able to give the minimum green feed requirement for their cows. As a result, they are never able to predict correctly the appropriate days for mating the animals particularly by artificial insemination.

Cattle raisers of Tirtomulyo not only collected grass in the close neighbouring villages of Murtigading, Tirtosari and Donotirto, but also from Samas and Parangtritis which are approximately six to eight kilometres distant. It is a common phenomenon in South Bantul for people to collect grass in neighbouring villages, because the *sawah* fields of those villages are contiguous. Even the settlements of those villages are very close. Gathering grass from neighbouring villages is done by all cattle raisers, while collecting grass in the Samas and Parangtritis villages is usually done by the tiny and landless farmers, using bikes which permit them to take more than one basket of grass. When collecting grass in neighbouring villages, they have a goal of one basket, and when gathering grass in the villages of Samas and Parangtritis, they have a goal to take three to four baskets, which can last as feed for approximately two or three days, depending on the number of cattle.

Without collecting grass beyond the village - and mainly in the villages of Samas and Parangtritis which are relatively far from the village - it would be impossible for the tiny farmers, mainly those who keep more than one head of cattle to meet their feed requirements. In the hamlets where most farm households keep cattle, as in Soropadan, Jebukan, and Karangweru, the demand

for wild grass is very high because they have little opportunity to get additional *palawija* by-products in their hamlets. They then gather outside the village, and most tiny and landless farmers prefer to gather in the Samas and Parangtritis villages which have a 'plentiful' grass supply. In the hamlet of Soropadan, a tiny farmer who kept one head of cattle reported that he more often collected wild grass outside than in his village. During one year, he spent 140 days gathering grass beyond the village, and approximately 50 days in the village.

Perceiving the grass-supply problem and the strong dependency on wild grass to cover the demand for green feed among the tiny farmers, a question arises as to how they can best meet the demand for grass feed because in all villages of South Bantul, the supply of wild grass is not sufficient to meet the consumption needs of all the cattle. The answer is that many cattle raisers in South Bantul have solved the problem of limited wild grass by using rice bran and rice straw as feed supplements, and by planting *kalanjana* on the banks of the Progo and Opak rivers, and on *sawah* land.

Many medium farmers in Tirtomulyo have resorted to using rice bran and rice straw as feed supplements. In neighbouring villages, as reported by government officials, most farmers, whether medium or tiny farmers, also use large quantities of rice bran and rice straw rather than grass feed. Furthermore, most farmers who live near the Progo and Opak Rivers, plant *kalanjana* in the edges of the river which allows them to reduce the demand for green feed from wild grass. The sub-district office actually disagrees with the planting of *kalanjana* on the river banks during the dry season when the water depth declines. However, at present the officers do not ban the villagers who plant their crops in these areas.

Unlike in Tirtomulyo, people in the several hamlets of Sanden sub-district plant *kalanjana* in the *sawah* which are considered unproductive land for *palawija* crops during the dry season. By planting *kalanjana*, they reduce the production of green feed from *palawija* by-products, but they increase the overall supply of green feed because the production of *kalanjana* per hectare is relatively high, 40 tonnes during the dry season.

5.6. Concluding Remarks

The long-term implementation of GR in Tirtomulyo has increased peasant welfare, and the capacities of the *sawah* to produce cattle fodder from crop by-products and wild grass from weeds. Both of them have supported an increasing cattle population. Nevertheless, increasingly the cattle population in the village exceeds the capacity of the *sawah* to supply the demand for cattle feed. In 1994, the carrying capacity of one hectare of *sawah* was 3.8 head of cattle, while the cattle density was 4.4 head of cattle. The crucial problem was that the proportion of green feed as the main feed was very limited, while the feed from crop by-products has become commodified. As a result, the concept of carrying capacity is less important than the concept of the distribution system to understand the livestock feeding system in the village.

In the cattle feed distribution system of Tirtomulyo, the status of crop by-products has changed from common property to individual property. Agricultural rationalisation and increasing demand for feed has pushed this change - which determines the level of feedstuff sufficiency among the cattle raisers. In the first step of agricultural rationalisation, farmers reorganised labour allocation to reduce harvesting costs. Changes from *bawon* to monetary wage, or *tebasan* in

the harvesting system was the first step of agricultural rationalisation. These changes meant that farmers began to commercialise their primary crop products.

In the second step of agricultural rationalisation, farmers began to commercialise secondary crop product by using them as a labour payment. Traditionally rice straw and soyabean 'straw' were not marketable therefore they were regarded as 'common property'. The use of rice straw as a means of labour payment appeared when the demand for this fodder increased due to the increasing cattle population. This rice straw commercialisation would not have occurred if the majority of cattle raisers were large and medium farmers who were able to achieve rice straw self-sufficiency. However, because the majority of cattle raisers were tiny farmers and they depended heavily on rice straw from others' *sawah*, they were forced to accept commercialisation.

Both the first and the second phases of agricultural rationalisation are similar, in the sense that tiny and landless farmers lose their opportunity for wage work in the harvesting system, but in the second phase those who do not keep cattle have very reduced opportunities to work during rice harvesting.

Changes in the patterns of feedstuff distribution do not reduce greatly the sustainability of livestock raising among the medium farmers. The greatest proportion of cattle feed is crop by-products, and they have sufficient of this fodder to sustain their feed demands. Their demand for grass feed which has become more scarce in the village can be reduced considerably by using their own *palawija* by-products and rice bran. The evidence that, on average, they keep two head of cattle which was higher than that of smaller farmers indicates that they had better feedstuff supplies.

The small farmers occupied the position between the medium and tiny farmers. They almost achieved rice straw self-sufficiency, and they were quite able to reduce the demand for green feed by using their *palawija* by-products and rice bran. Nevertheless, they consumed more wild grass to sustain their green feed supplies.

Tiny farmers and landless farmers have a difficult problem in achieving sustainable feedstuffs. They work hard to get cattle feed by participating in rice harvesting. Basically, they lost their income earnings as rice harvesters though they now receive rice straw as payment. The rice harvesting system is market oriented, so they are forced to work outside the village to obtain sufficient rice straw. Conversely, the *palawija* harvesting system is still based on local solidarity hence they collected that fodder in their community.

The process of feed commercialisation still gives opportunities to tiny and landless farmers to obtain feedstuff because the fodder can be exchanged for their labour rather than cash. However, their access to collect crop by-products is constrained by the strong competition among themselves and with larger farmers who also need them to enhance their feed supplies. As a result, wild grass which has become a scarce resource offers the best option to sustain their cattle feed requirements.

There is a dependency between livestock raising in Tirtomulyo and neighbouring villages. Exchanges of rice straw among the villages occur because of the variation of seasonal supplies and the market orientation harvesting system. However, in the case of wild grass, the farmers of Tirtomulyo consumed much of this fodder from neighbouring villages. Without the available wild grass

from neighbouring villages cattle raisers, particularly tiny farmers, would be unable to sustain their feedstuff consumption.

Chapter Six

CONCLUSION

This study begins with the argument, as Popkin suggests (1979:4), that peasants have an interest in lifting their subsistence level by allocating their household resources in short- or long-term investment. It also suggests that the changes in livestock raising can best be understood within the context of the agrarian changes which occurred under the long-term process of the GR.

This study follows the neoclassical approach adopted by Hayami and Kikuchi (1982) for analysing agrarian change in rural Java. However, the study also applies a neopopulist approach in analysing some aspects of agrarian changes which cannot be explained entirely by the neoclassical approach. Hayami and Kikuchi (1982:50-51; 156, 216-218) regard population pressure as more important than technological factors in affecting agrarian changes (See also Hart, 1986:6). The neopopulists suggest that both population pressure and technology affect agrarian changes, but in analysing agrarian changes they place more direct emphasis on the effects of technology (Hart, Turton and White, 1982:10; Hart, 1986:6). Both the neoclassicists and neopopulists conclude that the GR has allowed farmers to rationalise agricultural production. The neopopulists argue that the spread of technology together with population growth in rural Java has resulted in declining welfare because large farmers have reneged on the customary obligation to provide poor villagers with income-earning opportunities in order to cut production costs (Hart, 1986:6). On the other hand, the neoclassical approach proposes that the agricultural technology and infrastructure are effective means for preventing growing poverty and inequality (Hart, 1986:7).

This study reveals that population pressure has occurred in Tirtomulyo as evidenced by the large number of tiny and landless farmers. The pressure on land therefore is relatively high because they depend on their small plots of land to earn their living. Before the establishment of the GR, *sawah* productivity was not able to meet the needs of an increasing population, hence a majority of farmers lived in destitution. By exploiting homegardens for producing coconut sugar, farmers were able to reduce their poverty. At that time, the keeping of cattle did not develop into an important economic strategy.

Over the long-term the GR has increased rice and secondary crop production and enabled most farmers to achieve food sufficiency and a small surplus in crop production, leading to the increasing popularity of cattle raising in Tirtomulyo. The agro-ecological background of South Bantul encouraged farmers of Tirtomulyo to keep cattle as a response to rice and secondary crop intensification. Prior to the GR era, farmers of South Bantul raised cattle in order to improve their household livelihood from rice and secondary crop cropping systems. The GR supported the increasing popularity of cattle through crop and cattle feed production. Furthermore, in South Bantul, cattle raising has become an important alternative household activity where there are few work opportunities beyond the agriculture sector.

In Tirtomulyo, rice and secondary crop intensification has reduced the population pressure on land. However, different pressures on land have been generated among farmers with different attitudes to improving their economic base in the village. Larger farmers have wider alternatives to invest their income earning beyond agriculture and livestock. The fact that livestock raising gave low labour and capital returns led large farmers to leave this economic activity and

invest their production surplus in the other economic activities which are more profitable. It was only tiny, small and medium farmers who preferred to invest their income in cattle because they have fewer alternative investment opportunities than large farmers.

Keeping cattle became the best income source for tiny farmers who lived close to the poverty line. Cattle can be used as a saving and long-term investment to enhance their household economic security and mobility. Tiny farmers have become the largest group of cattle raisers. Their opportunity to become cattle raisers was conditioned by the fact that the minimum capital needed to keep cattle was relatively small.

Increasingly tiny farmers who depended heavily on fodder from beyond their *sawah* experienced increasing feed scarcity. Even though the GR has increased the supplies of fodder, the competition for fodder among cattle raisers has become strong. As a result, changes in the livestock feeding system emerged at the levels of feed property rights, feed distribution and strategies for feed sufficiency. Firstly, during the GR the amount of rice straw increased rapidly and came to be viewed as individual property. Secondly, *palawija* by-products use was also increasingly regarded as individual property. Wild grass, however, remained as common property. The changes and constants in feed property rights require different explanations, but all of them have a relation to the increasing process of agricultural rationalisation which is affected by population pressure and agricultural commercialisation.

Wild grass remained common property, even though it has become more scarce in the village. This phenomenon cannot be explained entirely by the neoclassical economic perspective. Wild grass in *sawah* has an ambivalent status

as weed and feed. Individual farmers maintained wild grass as common property not only to meet their public interests but also their personal interests. By regarding it as common property those who do not keep cattle gain much benefit because grass cutters reduce their burden of weed clearing.

The changes in feed property rights have been followed by changes in the distribution system. Changes in feed property rights was theoretically a matter of population pressures. When they become scarce, the status of these resources shift from common property to individual property (Hayami and Kikuchi, 1982:23). Feed commercialisation gave advantages to the farmers who did not keep cattle by reducing production costs. They commercialised their crop by-products as labour payment although those who initially needed rice straw as labour payment were cattle raisers.

Feed privatisation and commercialisation have reduced the access of tiny and landless farmers to feed supplies. They are forced to work in rice harvesting beyond the village in order to achieve feed sufficiency. They lost their work opportunity as rice harvesters, and they only received the straw of these crops as compensation. In addition, they have to gather wild grass in an exploitative manner which degraded the environment.

The rise of feed commercialisation, indeed, supports the argument that the GR has become responsible for economic inequality among farmers. In the case of livestock ownership, however, the process of economic inequality has not been pronounced. The proportion of larger farmers who own cattle was higher than smaller farmers, but the numbers of cattle were similar. This is because keeping cattle is more dependent on the capacity to provide feedstuff supplies than the amount of capital to purchase animals. Nevertheless, in relation to livestock feed

supplies, tiny and landless farmers actually received less profit than larger farmers. They worked harder than larger farmers to collect fodder. Even though the time allocation for collecting fodder was not taken into account in their cost-benefit calculation regarding their cattle raising, tiny and landless farmers actually lost the opportunity to utilise working time for other economic purposes. At present, this kind of feed commercialisation allows tiny and landless farmers to achieve feed sufficiency. However, in the future, the growing number of tiny farmers who keep cattle will suffer reduced opportunities to achieve feed sufficiency. They will face increasing commercialisation of feed as labour payment and as a commodity sold for cash.

This thesis stresses that Javanese farmers were creative in solving problems of limited resources in their villages. By keeping cattle, they increased the value-added component of their crop by-products which were previously regarded as secondary resources. However, agricultural intensification and cattle raising are only a short-term solution to population pressure. In the absence of rural industrialisation, cattle raising seems to become an important alternative income.

At present, cattle raising has a functional role in preventing the economic polarisation which could be stimulated by the technological impact of the GR[1].

[1] Hayami and Kikuchi (1982) suggest that in selected villages of Southeast Asia, the GR does not cause economic polarisation between the larger and the smaller farmers, but only economic stratification. They found that (1) both larger and smaller farmers have access to the new technology; (2) there is no significant difference in average rice per hectare between large and small farmers adopting high yielding varieties; (3) during the implementation of the GR, there was relative stability in farm-size distribution (1982:53;55, 60). In contrast, Hayami and Kikuchi (1982:53) show that in Russia and India, access to modern technology and agricultural commercialisation were monopolised by larger farmers. As a result, polarisation of rural communities into large commercial farmers and landless proletariat occurred because the large profit from its adoption has stimulated the adopters to enlarge their operational landholding. By comparing macro data of landholding in 1963, 1973, 1983, Manning (1989:19) supported

During the GR, indeed, because of cattle raising, the village economy has been marked by a process of economic differentiation rather than polarisation between larger and smaller farmers. Economic differentiation means that both larger and smaller farmers gain advantages from the rice and secondary crop intensification, even though larger farmers gain relatively greater benefits and have wider alternatives to invest their income. Economic polarisation might have occurred if the larger used their marked advantages and enlarged their economic base in agriculture by extending their land ownership or farm size at the expense of smaller farmers. By keeping cattle, tiny farmers, who suffered the negative effects of agricultural rationalisation, were able to improve their income and economic base[2] and were thus able to control their own land. Nevertheless, with regard to the development of livestock in the future, the struggle of tiny farmers to enhance their economic fortunes through cattle raising may have to compete with livestock industries (Hudayana, 1995:4). Currently, through the second long-term economic development plan, the Indonesian government is facilitating livestock industries to enlarge their production. With large amounts of capital and modern technology and by monopolising some feed supplies and controlling livestock markets, livestock industries could reduce the opportunity of small-scale producers to raise cattle.

Hayami and Kikuchi's arguments that during the GR there was no significant change in the farm-size between larger and smaller farmers. A majority of farmers held small plots of land.

[2] There are many factors (besides cattle raising) which help explain why the process of economic polarisation did not occur. Those factors are (1) the larger farmers invested their income beyond agriculture such as in education, (2) when they invested their income in agriculture, they did not extend their landholding but changed crop commodities to get more profit, and (3) by rice and secondary crop intensification, most tiny farmers achieved food sufficiency from their own farms and this stimulated them to keep control of their own land.

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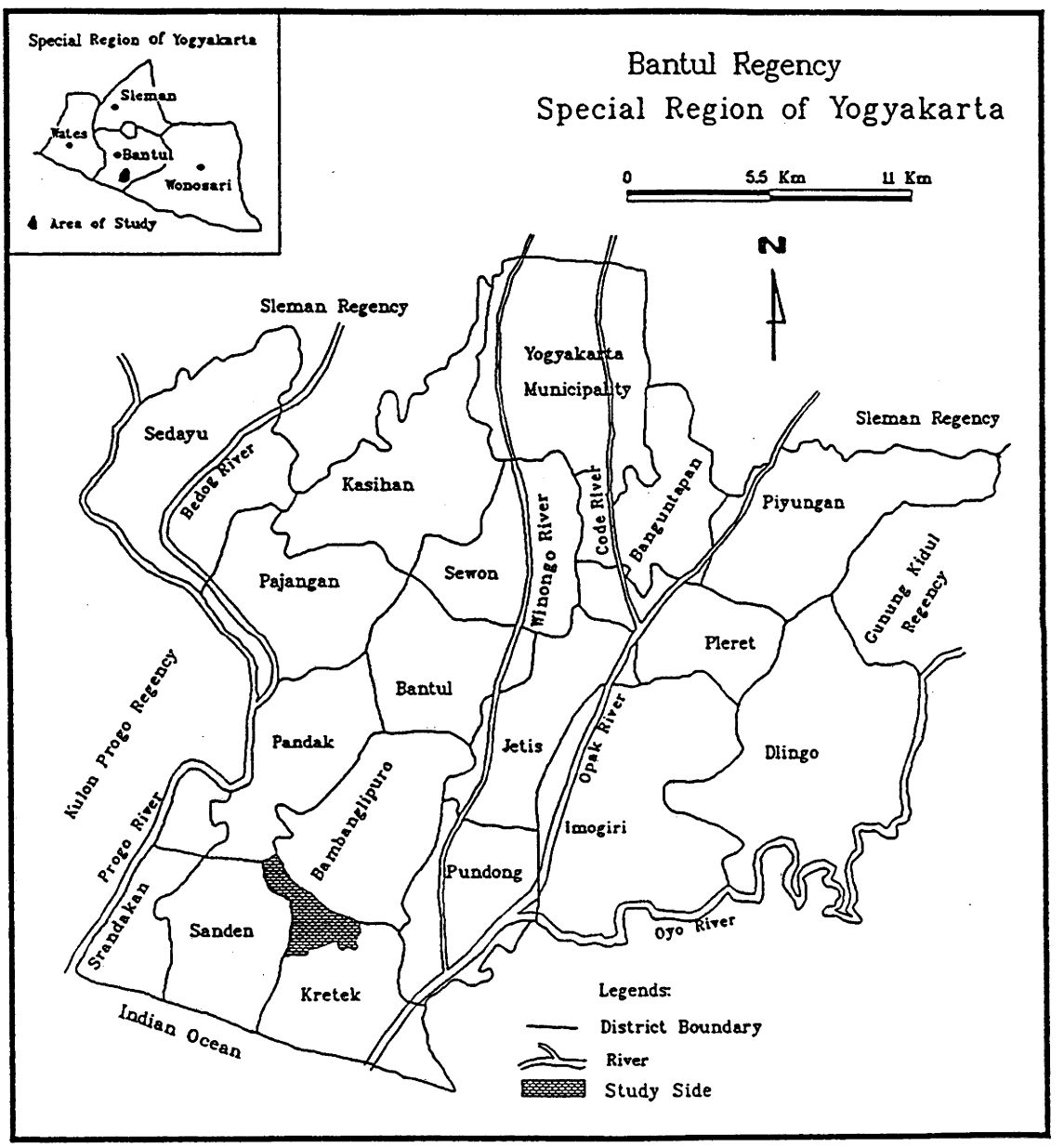
APPENDIXES

APPENDIX 1. Map of Bantul Regency



APPENDIX 2. Map of Tirtomulyo Village